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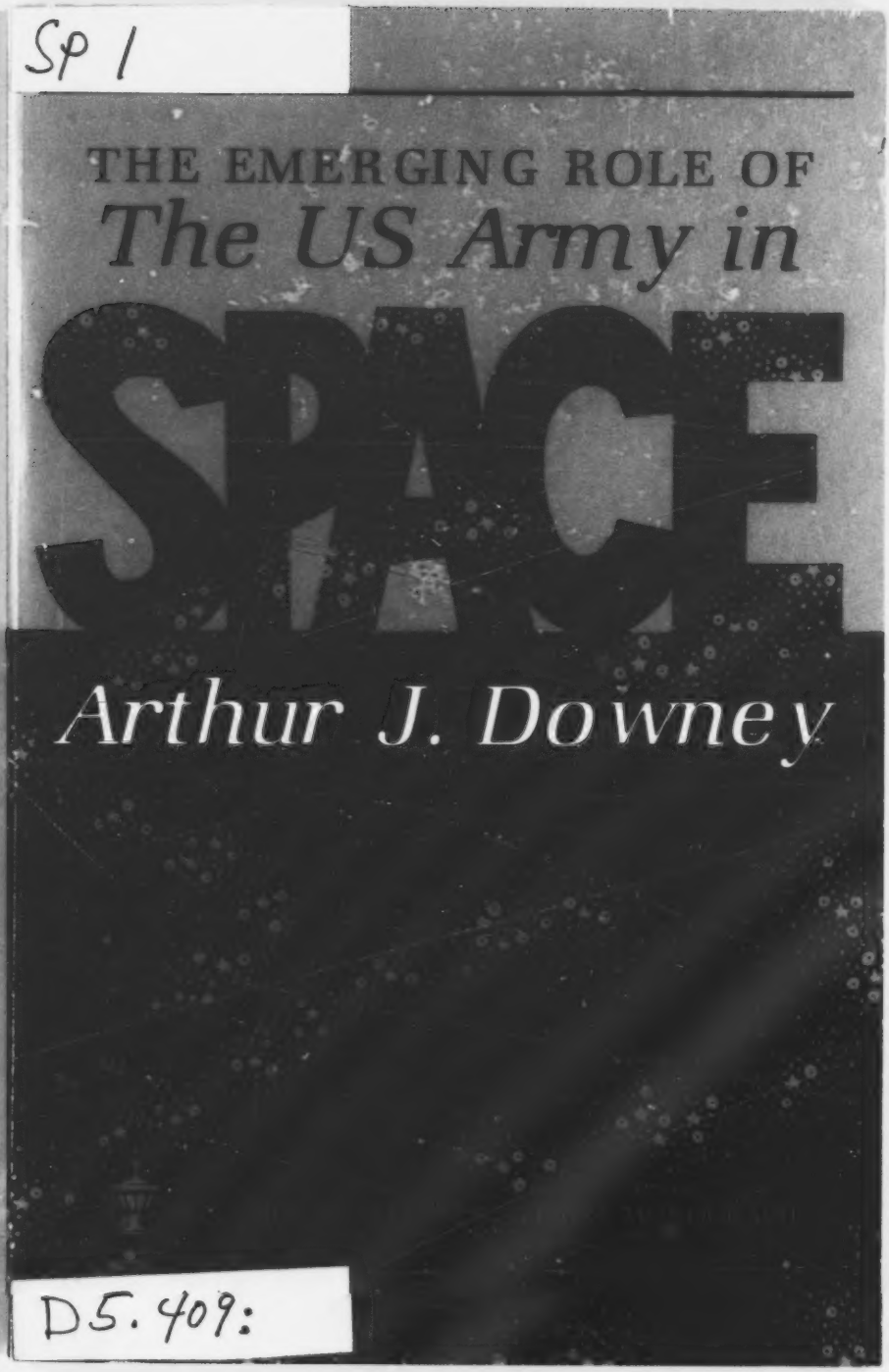
THE EMERGING ROLE OF *The US Army in* SPACE

Arthur J. Downey



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The Emerging Role
Of the US Army in

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Arthur J. Downey

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Foreword

The Air Force, exultantly, and the Navy, quietly, have organized separate space commands and are pursuing a multitude of space-related programs. The Army, despite playing a leading role in military space activities in the 1950s, does not yet have an operational space command. Its space-related efforts remain largely in the areas of research and development.

Does the Army have a role in space? According to Colonel Arthur Downey, US Army, the Army cannot ignore the potential applications of space technology to all military operations. Nor can the Army expect either the Air Force or the Navy to channel its resources to Army-specific missions. Colonel Downey recommends the Army tend its own business in space in three major areas: training space-qualified personnel, continuing research and development, and updating combat doctrine to take space technology into account.

Downey argues space is not a mission, but a *place*, a place where many missions can be performed. He believes to prevent or win future wars, the Army must more actively investigate the uses of space. The National Defense University is pleased to publish Colonel Downey's views.

Richard D. Lawrence
Lieutenant General, US Army
President, National Defense University

The Emerging Role
Of the US Army in

SPACE

Introduction

On the morning of 28 May 1940, Robert H. Goddard, the American rocket pioneer, met in Washington, DC, with representatives of the Army Air Corps, Army Ordnance, and the Navy. Goddard briefed the military representatives on work he was doing at his rocket test site in New Mexico and offered to develop rockets to meet future defense needs. The military politely turned him down, stating that manned aircraft could deliver more explosives, more accurately, than any foreseeable unmanned rocket.[1]

The Military Role in Space—A Historical Perspective

This initial short-sightedness of the military was also short lived, in large measure because of the Germans' use of the V–2 rocket against England. Although the V–2 never became a truly effective weapon in World War II, US military planners saw in it an interesting potential. The US Army mounted an extensive effort in the closing days of the war—code named Operation Paper Clip—to ensure that the United States received the benefit of the German rocket expertise. This effort culminated in the Army receiving the surrender of Wernher von Braun in May 1945. Before the end of that year, over 120 German rocket engineers had been gathered at Ft. Bliss, Texas, to work in the Army Ordnance Research & Development Suboffice (Rocket). The Army's initial interest in rockets

was as an adjunct to its long-range artillery. During the 1945–48 period, numerous rockets were developed and tested by von Braun's team, including the WAC (without altitude control) Corporal, the Corporal E, and various designs of the Hermes surface to surface missile (the C1 model was later produced as the Redstone). In 1950, the Army's rocket research facility was moved lock, stock, and barrel to Redstone Arsenal, near Huntsville, Alabama, signalling a separation of the missile program from conventional "tube" field artillery. In February 1956, with the Redstone and Jupiter missiles developed and in production, the Army placed Redstone Arsenal under the newly formed Army Ballistic Missile Agency. This agency was given the responsibility for design of future ballistic missile systems, including—the Army hoped—a new family of rockets with intercontinental range, the ICBMs.[2]

The other two Services had not been mere spectators in the Army's advance toward space, however. As early as 1945, both the Navy and the Air Force (still the Army Air Corps at that time) initiated studies to examine the potential of space ships, space bases, and space satellites. In 1946, the Navy proposed combined sponsorship of satellite programs. The Air Corps declined, however, and assigned a major satellite and space study to Project Rand. The Navy Bureau of Aeronautics signed contracts with Aerojet, North American Aviation, and Martin for propulsion and space vehicle engineering that same year.[3]

On 26 July 1947, President Truman signed the National Security Act of 1947, creating the Department of Defense and the three separate military departments of the Army, Navy, and Air Force. The Research and Devel-

opment Board in the Department of Defense (formerly the Joint Research and Development Board under the old War Department) inherited supervision of the military space studies as well as the programs to develop the ballistic missiles that would eventually be used as launch vehicles to propel satellites into earth orbit. In a March 1948 review of the Services' studies, the board judged the technical feasibility of earth satellites to be clearly established, but concluded that the military utility of these systems commensurate with their expected cost had not been demonstrated. The board recommended that the Navy continue limited development of rocket engines and tanks and that the Air Force have Rand continue studies on the military utilization of space.[4]

Because of budget constraints, the Navy soon reduced its space effort, but the Air Force was expanding its role rapidly. Rand's efforts in the early 1950s embraced space system and subsystem engineering design as well as studies of military uses of space, primarily focusing on the use of satellites for weather surveillance. In early 1954, the Rand Corporation proposed an Air Force ICBM program that, as a by-product, would provide the large rockets necessary for launching the military satellites it had recommended for development. The program would eventually produce the Atlas and Titan ICBMs and a shorter range missile called the Thor. It also placed the Army and the Air Force in direct competition for control of long-range ballistic missiles development, a competition in which the Army held the initial lead, as von Braun's team had successfully launched the Redstone ballistic missile in August 1953.[5]

In the mid 1950s, two separate series of events began to converge, a convergence that would provide the impe-

tus necessary to launch the US military into space. In August 1954, Congress approved US participation in the 1957–58 International Geophysical Year, and on 29 July 1955, Press Secretary James Hagerty released a statement that said, "The President has approved plans by this country for going ahead with the launching of small Earth-circling satellites as part of the United States participation in the International Geophysical Year."[6] Prior to this announcement, and in keeping with President Eisenhower's desire to emphasize the peaceful uses of space, NSC Directive 5520, issued in May 1955, directed that no missile intended for military purposes could be used to launch the IGY satellites. Two ballistic missiles being readied by the Services as satellite launch vehicles—the Army Redstone and the Air Force Atlas—were eliminated by the directive, and so a program was structured using a launch system based on the Navy Viking, an atmospheric sounding rocket. The Vanguard program was to be a civilian-controlled program; military participation was to be played down.[7]

At the same time that he was creating a civilian space program, President Eisenhower was becoming increasingly concerned about the Soviet military threat. In the spring of 1954, the President had met with the Science Advisory Committee of the Office of Defense Mobilization and explained his concern that nuclear weapons had made it too easy for a hostile nation with a closed society to plan an attack in secrecy that could cripple or destroy our nation. He challenged them to address this problem and provide him with recommendations. A special task force formed under the chairmanship of Dr. James R. Killian, president of the Massachusetts Institute of Technology, considered US requirements for conti-

nental defense, strategic strike forces, and strategic intelligence. The Technical Capabilities Panel, as the group eventually was called, worked for six months developing its report, *Meeting the Threat of Surprise Attack.* Presented to the National Security Council on 14 February 1955, the report resulted in significant changes in American defense priorities. The report contained several recommendations for highest priority effort:

1. Accelerating procurement of a liquid-fueled intercontinental missile (the Atlas ICBM).
2. Investigating solid propellant rockets for ICBM applications (the Minuteman program).
3. Developing and deploying land- and sea-based intermediate-range ballistic missiles (Thor, Jupiter, and Polaris IRBMs).
4. Speeding construction of the Distant Early Warning radar line across the Arctic.
5. Deploying, as soon as possible, high-altitude reconnaissance aircraft to collect intelligence against the Soviet Union (the U–2).[8]

Although President Eisenhower preferred to emphasize the peaceful uses of space, he recognized its strategic importance and the necessity for a military presence there by approving the Panel's recommendations.

Based on the President's decision, the United States set out to pursue two separate space programs, one civilian and one military, one open to the world's scrutiny and one closed. The Vanguard program was placed under the National Science Foundation, with the Department of Defense providing logistical and technical

support. Because the program was using modified Navy Viking and Aerobee-Hi sounding rockets, the Navy was named to act for DOD. The Army's space effort languished. At the Army Ballistic Missile Agency, under the command of Maj. Gen. John B. Medaris, von Braun's plan to orbit a satellite using the Jupiter C, a Redstone derivative, gathered dust while the civilian Vanguard project slowly moved ahead toward a late 1957 launch date.[9]

On 4 October 1957, a surprised and shocked America awoke to find that the Soviet Union had successfully launched the 184-pound satellite, *Sputnik I.* Dr. Killian, who was about to be named President Eisenhower's Special Assistant for Science and Technology, recalled later that *Sputnik* "created a crisis of confidence that swept the country like a windblown forest fire." This fire was fanned to incandescence in December 1957 when the first Vanguard rocket blew up on the launching pad. Headlines around the world called America's Vanguard the "Stayputnik."[10]

Congress and the American public demanded reassurance—and action. To restore public confidence at home and prestige abroad the administration directed the Army to proceed with von Braun's Project Orbiter. On 31 January 1958, the Army's Jupiter rocket (with a solid-propellant fourth stage giving the launch vehicle the name Juno) placed the *Explorer I* satellite into Earth orbit. The US military was in space to stay, and the Army—at least initially—was in the forefront.

Encouraged by the Army's success, Washington then made plans for even more ambitious programs. In February 1958, Congress authorized DOD to establish the

Advanced Research Projects Agency (ARPA), and the President assigned this new organization the responsibility for directing all US space efforts. The Air Force, believing that it should play a major role in space, developed a broad program consisting of 21 major projects, including satellite systems, manned hypersonic vehicle research, and a manned lunar base and submitted it to ARPA.[11]

The plans of the Air Force and the other two military departments were reined in sharply on 2 April 1958 when President Eisenhower asked Congress to approve the establishment of the National Aeronautics and Space Administration (NASA) to conduct all US space activities other than those directly associated with national security. Although it reflected the President's views on the desirability of civilian control of space endeavors, the legislative proposal left the NASA-DOD relationship vague. Congress, however, formalized the dual civilian-military aspects of the US space program in the wording of the final act:

> The Congress declares that the general welfare and security of the United States require that adequate provision be made for aeronautical and space activities. The Congress further declares that such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense....

On 29 July 1958, the President signed the National Aeronautics and Space Act (Public Law 85–568), creating NASA. In November 1958, NASA acquired elements of

the Naval Research Laboratory, to include Project Vanguard, and directed their move to the New Goddard Space Flight Center near Greenbelt, Maryland. In December 1958, two Army space programs were transferred to NASA: the launch vehicle program under Dr. von Braun at Redstone Arsenal (the facilities redesignated as the Marshall Space Flight Center) and the *Explorer* satellite program at the Jet Propulsion Laboratory in Pasadena, California.[12] The Army's role was reduced even further that year when the Air Force was given the Jupiter IRBM program and the responsibility for ICBM development and deployment. With NASA's absorption of the major Army and Navy space capabilities, the Air Force was left as the primary military space player, but with NASA and the civilian side of the space program receiving the majority of the funding and attention. During the late fifties and early sixties, with the exception of communications satellites, the military departments were unable to justify their requirements for space systems. The successful NASA Apollo program, launched by President Kennedy, saw the US civilian space program reach its apogee. Almost immediately after Neil Armstrong's "one small step" to the lunar surface on 20 July 1969, however, NASA faced waning public interest and congressional budget cuts and had to cut back its programs. Without the support of the Nixon and Carter administrations, major NASA space efforts, such as the space station, remained on the drawing boards. Fortunately for the United States, national security requirements, accentuated by an expanding Soviet threat, have somewhat insulated the DOD space program from the same spending constraints that have recently plagued NASA. In fact, starting around 1975, the total US space budget has

shown a steady growth because of a new emphasis on the military uses of outer space, as shown in figure 1.

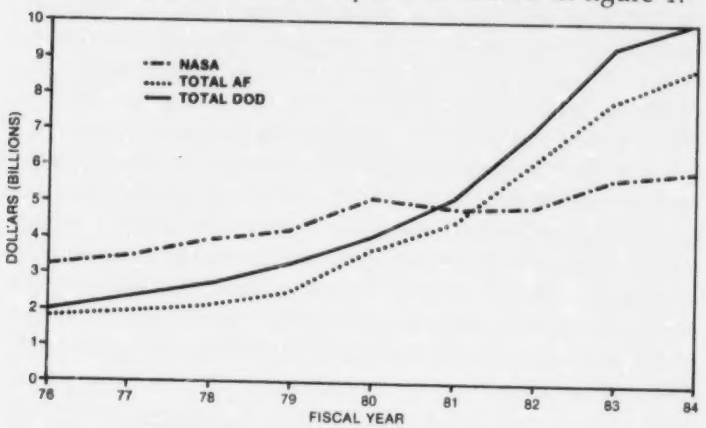


Figure 1. United States space activities

The Military Importance of Space

> Space-based systems have clearly demonstrated their ability to support the planning and execution of US military operations, thereby contributing to US deterrent capabilities. The US military space effort continues to expand. A number of space systems are now operational and provide important support to operational commanders. The United States must be able to continue this essential support at critical times during conflict.[13]

These words appear in the 1985 version of the Joint Chiefs of Staff Military Posture Statement, reflecting their recognition of the growing military importance of space and our increasing dependence on space systems for the effective employment of United States military forces.

Space systems have been designed to support both peacetime and wartime military operations in such areas as communications, surveillance, treaty monitoring, ballistic missile attack warning, nuclear detonation detection and monitoring, navigation, geodesy, and weather reporting. Many functions and capabilities provided by these space systems are unique; they cannot be duplicated by airborne or ground-based systems. The US military commander today, almost unknowingly, depends to an ever-greater extent on space-based systems for information concerning the terrain, weather, and the strength and disposition of enemy forces. Military space systems act as force multipliers for the field commander by helping him more effectively control his widely dispersed men and materiel.

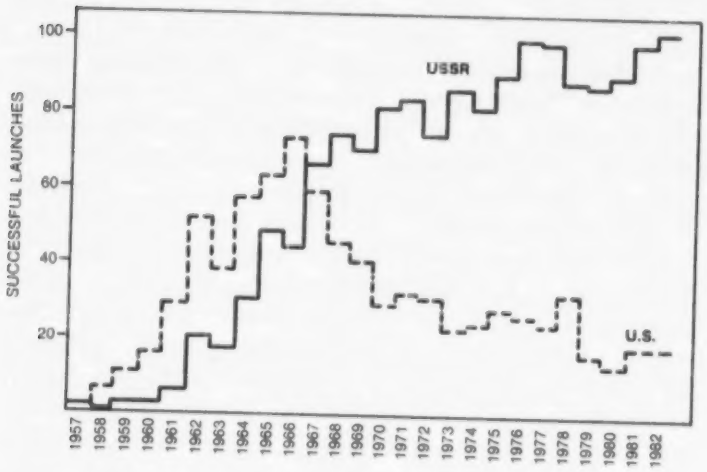
As new and more capable space craft become operational in the next 5 to 10 years, there may be an even more dramatic shift toward using space systems for battlefield management, precision weapons delivery, nuclear missile retargeting, and secure high-capacity communications for conducting conventional or nuclear war. Probably before the end of this century, we may see space-based weapons systems deployed. If developed and deployed, space systems of the future could perform such tasks as surface attack, defense suppression, close support, battlefield interdiction, and antinaval and antisubmarine warfare.

The Soviet military space program has space systems providing communications, reconnaissance and surveillance, navigation, and weather reporting. The Soviets currently possess the world's only operational weapon for use against space targets, their co-orbital anti-satellite (ASAT) system. The Soviet military space program is

expansive; they certainly realize the military value of space. Although military competition with the USSR is not the reason for intensifying US space efforts, it could well be a vital one. Figure 2 demonstrates US versus Soviet space launches.

For maximum deterrence of Soviet aggression in space, we must exploit our advantage in technology. President Reagan's Strategic Defense Initiative proposes doing just that—using our superior technology for a research program so informed decisions can be made in the early 1990s on whether to commence development of a ballistic missile defense system capable of defending the US and our Allies. Such a system would rely heavily on space platforms for surveillance, warning, target acquisition, and tracking and as battle stations for the weapons themselves, especially directed-energy weapons, which are more accurate and efficient outside the effects of the atmosphere. Although it may be impossible to create a "perfect," i.e., leak-proof, defense against ballistic missile attack, a multilayered (space-based, airborne, and ground-based) strategic defense system that would effect massive cumulative attrition on a Soviet missile attack is both feasible and desirable. The system, or portions of it, could probably be designed to also have utility against aircraft and cruise missile attack, thus becoming a true Strategic Defense System. President Reagan's Strategic Defense Initiative could not work without military space systems, demonstrating most dramatically the military importance of space. However, the question remains whether the capabilities of space warfare that may emerge would be an evolutionary military development and should be exploited only as force multipliers, additives, and levers in support of current strategic and

tactical doctrine, or whether these capabilities would collectively constitute a true revolution in warfare that would require completely new doctrine.



Soviets:

—Spending $20 billion versus $8 billion on mil-space
—5:1 ratio lead in space launches over the United States
—85 percent of Soviet launches are military
—Two new boosters in development
—Saluyt-7 modular space station
—Developing shuttle look-alike (RAMR)
—Cosmos 1445 space plane
—Total number of man-days in space as of 1 August 1984:
—USSR—3,436
—US—1,094
—World's only operational ASAT system

Figure 2. Soviet space launch activity

In short, space has evolved from a minor military mission to "the new high ground"—a theater of operations that must be exploited because of its tremendous military potential. Von Clausewitz stated that control of the high ground offered the commander three strategic assets: greater tactical strength, protection from access, and a wider view.[14] Certainly control of space would provide these assets—or military advantage—in an unprecedented manner.

1 / Space Policy: Goals and Directions

United States national policy relating to space is embodied in an interrelated framework of international treaties, congressional legislation, Executive orders, and Presidential letters and directives. The most pertinent of these instruments which relate to the military use of space follow:

The Limited Test Ban Treaty of 1963.

The Treaty on Principles Governing the Activities of States in the Exploration and Uses of Outer Space, Including the Moon and Other Celestial Bodies (commonly called the "Outer Space Treaty") of 1967.

The Anti-Ballistic Missile (ABM) Treaty of 1972.

The National Aeronautics and Space Act of 1958 (Public Law 85–568).

Presidential Directives No. 37 and 42, issued in 1978.

Department of Defense Space Policy Statement released on 11 August 1982.

National Security Decision Directive (NSDD) No. 85, dated 25 March 1983, titled "Eliminating the Threat from Ballistic Missiles."

National Security Study Directive (NSSD) No. 6–83, dated 18 April 1983.

Key elements of these documents have a pronounced impact on the military use of space.

International Treaties

The Limited Test Ban Treaty of 1963 was signed in Moscow on 5 August 1963 and ratified by the US Congress on 10 October 1963. This treaty prohibits any nuclear weapons test or any other nuclear explosion in outer space, thus foreclosing the option of a nuclear-armed ASAT or exoatmospheric nuclear ABM system.[1]

The Outer Space Treaty was first considered by the United Nations in 1966 and entered into force on 10 October 1967. It is the principal international agreement that deals with military space-related activity. Article IV of the treaty prohibits the placement of nuclear weapons or any other kinds of weapons of mass destruction in earth orbit, the installation of such weapons on celestial bodies, or the stationing of such weapons in outer space in any manner. It does not prohibit the use of ICBMs with nuclear warheads in either suborbital or fractional orbit trajectories, however. The phrase "any other kinds of weapons of mass destruction" used in the treaty is not explicitly defined, but the generally accepted view is that it includes nuclear, chemical, and biological weapons but not necessarily directed-energy weapons. Article IV also specifies that the moon and other celestial bodies are to be used exclusively for peaceful purposes. The Soviets have officially defined this phrase to mean "nonmilitary," although the United States has interpreted it in a less restrictive manner as "nonaggressive." Although military personnel may be used for scientific research or any other peaceful purpose in space—the majority of both US and Soviet astronauts have been military personnel—certain specific activities are prohibited on celestial bodies, such as the establishment of military bases, installations, or

fortifications; the testing of weapons; and the conduct of military maneuvers. This treaty does not prohibit manned military space stations, nor does it prohibit space-based weapons per se.[2]

The Anti-Ballistic Missile (ABM) Treaty signed by the United States and the Soviet Union in 1972 and modified by protocol in 1976 prohibits each country from deploying anti-ballistic missile systems for defense of its entire territory. Under the treaty and its protocol each country is limited to one ABM system with no more than 100 interceptor missiles for the point defense of either the nation's capital or an intercontinental ballistic missile launch complex. Because of questions of effectiveness and rising costs the United States never put its allowed system into operation. The Soviets set up theirs around Moscow, and it is operational. Article XII of the treaty prohibits interference with national technical means of verification of treaty compliance, and article V prohibits the development, testing, or deployment of ABM systems or *components* that are sea-based, air-based, *space-based*, or mobile land-based. The latter provision presumably includes space-based radars or other sensors used for target acquisition and tracking of ballistic missiles for ABM defense purposes.[3]

Despite public belief in the sanctity of treaties, the suggestion that international space treaties can serve as an effective ban on the introduction of weapons in space is highly questionable. Included within the three major treaties are articles for either amendment or termination of their provisions. Article IV of the Limited Test Ban Treaty permits any of the signatories to withdraw after three months' advance notice. The ABM Treaty provides for amendment and allows either party to withdraw after

six months' notice. Article XVI of the Outer Space Treaty provides for unilateral signatory withdrawal from the treaty provisions one year after notification of intent. The Soviets have abrogated treaties in the past when they felt it was in their national interest. Thus existing space treaties would give the United States no more than one year to recover from the announcement of Soviet intention to deploy space military systems that fall outside the confines of those agreements.

The Soviets may choose to violate the provisions of the space treaties without notification or explanation. They have constructed a large phased-array radar near the village of Abalakova in south-central Siberia that appears to be in violation of the provisions of the ABM Treaty.[4] Radars of this kind used for detecting and tracking ballistic missiles are huge, requiring years to construct.

The United States regards its treaty obligations as immutable; however, we should recognize that treaties must be continually evaluated and that we must assess treaty obligations in terms of our national security interests.

US Legislation and Executive Orders

The National Aeronautics and Space Act of 1958 established NASA and defined the two-track US space program with separate civilian and national security activities that has carried forward to the present day. From the military viewpoint the act is important because in it Congress specifically recognized the space responsibilities of the Department of Defense.[5]

Presidential Directive Nos. 37 and 42, issued by President Carter in 1978, contained general space policy concerning military/civilian cooperation in space and the need for free access to space, established a policy of more integration and technology transfer with the National Space Program, and also charged NASA to continue the development of the Space Shuttle.[6]

In August of 1981, President Reagan directed the head of the Office of Scientific and Technical Policy (OSTP), Dr. Jay Keyworth, to conduct a comprehensive review of our national space policy to determine if new direction was needed. At the same time the Department of Defense was chartered by Secretary Weinberger to commence a parallel effort to develop a DOD space policy to guide the Services in the future military uses of space. On the 4th of July 1982, the President announced his national space policy. Basic goals of the United States space policy are to:

—strengthen the security of the United States;

—maintain United States space leadership;

—obtain economic and scientific benefits through the exploitation of space;

—expand United States private sector investment and involvement in civil space and space-related activities;

—promote international cooperative activities in the national interest; and

—cooperate with other nations in maintaining the freedom of space for activities which enhance the security and welfare of mankind.

Expanding upon these goals, the President established the following principles underlying the conduct of the US

space program; as outlined in the directive, the principles are:

1. The United States is committed to the exploration and use of space by all nations for peaceful purposes and for the benefit of mankind. "Peaceful purposes" allow activities *in pursuit of national security goals.*

2. The United States rejects any claims to sovereignty by any nation over space or over celestial bodies, or any portion thereof, and rejects any limitation on the fundamental right to acquire data from space.

3. The United States considers the space systems of any nation to be national property with the right of passage through and operation in space without interference. Purposeful interference with space systems shall be viewed as an *infringement upon sovereign rights.*

4. The United States encourages domestic commercial exploitation of space capabilities, technology, and systems for national economic benefit. These activities *must be consistent with national security concerns,* treaties and international agreements.

5. The United States will conduct international cooperative space-related activities that achieve scientific, political, economic, or *national security benefits* for the nation.

6. The United States space program will be comprised of two separate, distinct and strongly interacting programs—*national security* and civil. Close coordination, cooperation and information exchange will be maintained among these programs to avoid unnecessary duplication.

7. The United States Space Transportation System (STS) is the primary space launch system for both *national security* and civil government missions. STS capabilities and capacities shall be developed to meet appropriate national needs and shall be available to authorized users—domestic and foreign, commercial and governmental.

8. The United States will pursue activities in space in support of its right of self-defense.

9. The United States will continue to study space arms control options. The United States will consider verifiable and equitable arms control measures that would ban or otherwise limit testing and deployment of specific weapons systems, should those measures be *compatible with United States national security* [emphasis added].[7]

Each of the above principles either explicitly or implicitly addresses aspects of US national security.

Although the President announced his space policy at a press conference at Edwards Air Force Base on the occasion of a Shuttle landing, a more comprehensive White House Fact Sheet was released on 4 July 1982. The directive stated, the United States will conduct those activities in space that it deems necessary to its national security. National security space programs shall support such functions as command and control, communications, navigation, environmental monitoring, warning, surveillance and space defense. The directive stated the following policies for the national security space program:

—Survivability and endurance of space systems, including all system elements, will be pursued commensurate with their planned use in crisis and conflict, with the threat, and with the availability of other assets to perform the mission. Deficiencies will be identified and eliminated, and an aggressive long-term program will be undertaken to provide more assured survivability and endurance.

—The United States will proceed with development of an anti-satellite (ASAT) capability, with operational deployment as a goal. The primary purposes of a United States ASAT capability are to deter threats to space systems of the United States and its Allies and, within such limits imposed by international law, to deny any adver-

sary the use of space-based systems that provide support to hostile military forces.

—The United States will develop and maintain an integrated attack warning, notification, verification, and contingency reaction capability which can effectively detect and react to threats to United States space systems.

—Security, including dissemination of data, shall be conducted in accordance with Executive Orders and applicable directives for protection of national security information and commensurate with both the mission performed and the security measures necessary to protect related space activities.[8]

Clearly, the new policy emphasized the strategic military value of space and its importance to national security.

The directive also established a Senior Interagency Group (SIG) on Space to provide a forum for all Federal agencies for their policy views, to review and advise on proposed changes to national space policy, and to provide for orderly and rapid referral of space policy issues to the President for decisions as necessary. The SIG (Space) is chaired by the Assistant to the President for National Security Affairs and includes the Deputy Secretary of Defense, Deputy Secretary of State, Deputy Secretary of Commerce, Director of Central Intelligence, Chairman of the Joint Chiefs of Staff, Director of the Arms Control and Disarmament Agency, and the Administrator of the National Aeronautics and Space Administration.

A classified DOD space policy document was approved by Secretary Weinberger and official announcement of the policy statement was made on 11 August

1982. An unclassified fact sheet issued on that date is quoted, in part, as follows:

> The Secretary of Defense has recently approved a classified statement of policy designed to guide the space-related activities of the Department. The policy is a result of an internal Department of Defense study of the space environment and its relations to national security. The purpose of the study was to produce a space policy that is consistent with international law and national policy, and that would provide focused and coherent broad policy guidance for future DOD space-related activities.[9]

The policy directs the continued maintenance of a strong technology base, as authorized in the National Aeronautics and Space Act of 1958, with emphasis on those areas necessary for effective defense. The policy recognizes that space systems can effectively support a number of military missions and that future use of space should have an operational orientation. The policy contains no new directions in space weapons but provides for continued research and planning.

On 23 March 1983 President Reagan, in what has come to be known as his "Star Wars" speech, called for a "comprehensive and intensive effort to define a long-term research and development program to begin to achieve our ultimate goal of eliminating the threat posed by strategic nuclear missiles." On 25 March 1983, National Security Decision Directive No. 85, "Eliminating the Threat for Ballistic Missiles," was issued, formally outlining the President's strategic defense initiative. The President challenged the defense–high technology industry community to investigate the feasibility of defending the United States against ballistic missiles. Scarcely less demanding was the implicit challenge to defense policy makers that they evaluate the advantages and disadvan-

tages of moving from an offense-dominant strategic posture to one in which defensive capabilities would have a major role. For a change, policy guidance had been established that was far ahead of existing strategy and technology. The controversy over the wisdom, desirability, and feasibility of this guidance continues, however, among members of Congress, the press, and the scientific community.

National Security Study Directive No. 6–83, entitled "Study on Eliminating the Threat Posed by Ballistic Missiles," directed that two studies be made. One, the Future Security Strategy Study, was to assess the role strategic defensive systems developments could play in future national security policy, and the other, the Defensive Technologies Study, was to define a long-term research and deployment program to achieve the President's initiative. The Defensive Technologies Study Group was headed by James C. Fletcher, former Administrator of NASA. The Future Security Strategy Study Group was headed by Fred S. Hoffman, director, Pan Heuristics, a division of Research and Development Associates.[10]

Study findings were presented to the President on 18 October 1983. To manage the Department of Defense efforts under the President's Strategic Defense Initiative, the concept of centralized control and decentralized execution was decided upon. On 27 March 1984, Secretary Weinberger announced the appointment of Lt. Gen. James A. Abrahamson to fill that position. Lieutenant General Abrahamson, formerly the head of NASA's Office of Space Flight and director of the Space Shuttle program, reports directly to the Secretary of Defense. He

also serves as the DOD focal point for reporting to the Congress on the program's progress.[11]

Because the Army had an active BMD program within the Department of Defense, the Army has been in and continues to play a major role in research and development of ground-based BMD systems and components. Because research and development of certain space-based systems were being included in Strategic Defense Initiative programs, the Air Force is also deeply involved. (Ballistic missile defense will be addressed further in chapter 4.)

2 / The Present Military Roles and Missions in Space

Space has become vital to the conduct of United States military operations, not necessarily because weapons of destruction could be employed from space, but because the information and data necessary to conduct a modern war on earth depend to an increasing degree on satellites. A shrinking US global presence has caused us to rely more on remote sensing and long-distance communications and monitoring facilities to satisfy our national security commitments.

The present military uses of space include the following:

—Surveillance

—Attack warning and assessment

—Communication

—Navigation

—Meteorology

—Geodesy

—Space defense/ASAT

The United States has space systems that perform the missions just listed, both those operational now and systems that will become operational within the next five years.

Surveillance

Surveillance refers to a fairly regular monitoring activity. Since the early 1960s, surveillance spacecraft have

been placed in orbit. Most information concerning these space systems is classified.[1]

Attack Warning and Assessment

The United States employs satellites to provide initial early warning of an enemy ballistic missile launch. These satellites, in geosynchronous equatorial orbit, detect missiles in the boost phase of flight, using infrared sensors. Because rocket plumes of ICBMs and SLBMs have a radiance level that is easily detected, even at the geosynchronous altitude of 22,300 miles, warning can be provided in near real time. Major efforts are underway to make the system, one of the key elements in US defense posture, more robust. Mobile, survivable ground terminals are being procured to reduce system dependence on the present fixed ground stations, and improvements are being made to the satellite itself to reduce vulnerability to countermeasures.[2]

To provide attack, damage, and strike assessment information, a system of improved nuclear detonation detection sensors has been developed. Formerly known as the Integrated Operational Nuclear Detection System (IONDS) and now called the Nuclear Detection System (NDS), these sensors will be deployed on board the NAVSTAR Global Positioning System (GPS) constellation of navigation satellites scheduled to achieve full operational capability in the late 1980s. The Nuclear Detection System will provide precise location, yield, and height of burst information on any nuclear explosion worldwide. During peacetime, NDS will contribute to nuclear test ban monitoring; during the nuclear war it will also provide damage and strike assessment.[3] If nuclear escalation

is to be controlled, this system is essential to the United States as a survivable means of providing accurate, near real-time information on nuclear weapon results, both ours and the enemy's, allowing the National Command Authorities to select an appropriate response and enhancing retargeting and strategic force management. Terminals for NDS will come in tactical versions to provide the same nuclear detonation (NUDET) information to field commanders.

Communication

From the very beginning of space operations, the transmittal of communications across international frontiers was an exciting prospect, and communications satellites share with weather satellites the distinction of being the most developed application resulting from the space age. The fact that at the present time between 70 and 80 percent of all US military long distance communications are transmitted via satellite attests to the importance of space for military command and control. With military forces deployed around the world, it is both technically efficient and politically advantageous to use satellite relays instead of terrestrial communications.

Military satellite communications, commonly abbreviated MILSATCOM, support strategic, tactical, and long-haul administrative communications users. The more important MILSATCOM systems are the Defense Satellite Communications System (DSCS), the Air Force Satellite Communications System (AFSATCOM), the Fleet Satellite Communications System (FLTSATCOM), and the Satellite Data System (SDS). A new system, Milstar, will be the heart of a survivable and enduring

MILSATCOM architecture being developed as part of President Reagan's strategic modernization program.[4]

DSCS. The Defense Satellite Communications System is a high-capacity, super high-frequency (SHF) system designed to satisfy the unique and vital national security communications requirements for worldwide military command and control, intelligence information transfer, diplomatic telecommunications, and crisis management. DSCS, at present, consists of one phase III satellite and three active, and four spare, phase II satellites, all in geosynchronous orbit. The four active satellites are positioned, one, over the Indian Ocean; one, over the Atlantic; and, two, over the Pacific Ocean to provide complete coverage of the earth except for the two polar regions. The phase III satellites, which will eventually replace the phase II satellites, incorporate many improvements. Phase III satellite design lifetime has been extended to 10 years, twice that of its predecessor; it is hardened against nuclear effects and has enhanced antijam features; it has more power and greater channel capacity. DSCS earth terminals range from large, permanent ground stations, using 60-foot parabolic antennas, to small portable units. Certain configurations are used on-board ships and aircraft; mobile terminals are used to support Army tactical operations.

FLTSATCOM. Designed to meet the special needs of the Navy, FLTSATCOM's system consists of four geostationary satellites operating in the UHF band. All US Navy ships are now equipped to receive the FLTSATCOM fleet broadcast, and many vessels also have a transmit capability. Limited jam resistance for fleet

broadcast (shore commands to ships) is provided by the current system.

AFSATCOM. The Air Force conceived of its evolutionary satellite communications system to provide the National Command Authorities (NCA) and the unified and specified CINCs with worldwide secure, survivable communications for command and control of the nuclear-capable forces. The initial phase, AFSATCOM I, provides essentially worldwide coverage along with a modest antijam capability. The space segment consists of transponders on geostationary FLTSATCOM and DSCS III satellites and on polar-orbiting SDS satellites. The earth segment consists of a family of terminals installed in the large, fixed command centers serving the NCA and the CINCs, their airborne command posts, SAC bombers, the ICBM launch-control centers, and the Navy SLBM TACAMO aircraft.

SDS. The SDS consists of satellites in a highly inclined polar orbit. Moving slowly toward or away from apogee over the North Polar region, these SDS satellites are visible to key northern latitude facilities on each orbital pass. The satellites, properly spaced, are able to provide continuous coverage of the area.

Milstar. Although both AFSATCOM and FLTSATCOM represent a significant increase in capability insofar as connectivity, coverage, and reliability are concerned, increased dependence dictated that vulnerabilities in the current systems be eliminated. Milstar is the next generation MILSATCOM system which will provide a more survivable and enduring communications capability into the next century. The new system will

provide low-capacity, jam-resistant communications for our strategic and tactical forces worldwide. Principal users of Milstar will be the strategic nuclear-capable forces, the Navy, and tactical mobile forces of the Army, the Marine Corps, and the Air Force. The earth terminal segment of the Milstar system will consist of terminals located on aircraft, ships, submarines, armored track vehicles, and jeeps and at fixed ground sites. The system design will incorporate both electronic and physical survivability features to counter jamming and physical threats and provide protection against nuclear effects. Milstar and DSCS III will be complementary systems; Milstar will not replace DSCS. It is a joint Army/Navy/Air Force program.

Navigation

The United States launched its first ocean navigation satellite on 13 April 1960, the beginning of the TRANSIT series of satellites, whose principal purpose was to provide accurate location fixes for the inertial navigation systems of the SLBM-carrying submarines. A major improvement in the quality and flexibility of this space-based navigational assistance will be provided by the NAVSTAR/GPS (Global Positioning System). Users will be able to determine their location in three-dimensional space with an accuracy of 15 to 21 meters; in addition they will receive accurate time and be able to determine their precise velocity. Users receive data from GPS satellites—for users it is a passive system—and user location is not disclosed. Available on a 24-hour global basis under all weather conditions, the satellites broadcast con-

uously over jam-resistant radio communications links.

e GPS space segment will consist of 18 satellites and

will also host the nuclear detonation detection system (NDS) payloads. The user terminal equipments will be provided in configurations for fixed locations, aircraft, ships and submarines, vehicles, and portable manpack. Having extremely accurate, continuous, common-grid, three-dimensional position and velocity data will increase military force effectiveness by enhancing all types of military operational planning and weapons delivery. The system is scheduled to be fully operational in 1988.[5]

Meteorology

The Defense Meteorological Satellite Program (DMSP) supports DOD needs for weather information. DMSP consists of two satellites in circular polar, sun synchronous 500-mile altitude orbit. Using visible light and infrared imagery, weather information from all points on the earth can be obtained at least four times a day. Global weather data is stored on the satellites and later transmitted to the Air Force Global Weather Control or to the Navy Fleet Oceanography Centers. Regional weather data are transmitted in real time to transportable read-out stations at key locations worldwide to support Army, Navy, and Air Force tactical operations.[6] The utility of real-time weather information in planning military operations is tremendous—General Patton would not have required "Divine Intervention" to ensure clear skies during his movement of the US Third Army to engage the Germans in the Battle of the Bulge with a DMSP read-out station! Details on cloud cover can be used to assist in real-time adjustment of reconnaissance missions; more accurate long-range forecasts play a major role in planning military operations; and wind speed and direc-

tion and precipitation assist in forecasting the effects of smoke, gas, or nuclear weapons.

Geodesy

The Geodetic Satellite Program of the US Defense Mapping Agency has utilized information from satellites since the mid-1960s. The type of activities included in the program go far beyond the production of traditional military map sheets. Accurate mapping is essential for precise ballistic missile launch and impact point location; topographical mapping is essential for the terrain contour matching guidance systems of our latest cruise missiles; precise measurement of the earth's gravitational and magnetic fields, particularly over the polar regions, is necessary to ensure the accuracy of the inertial guidance systems of our ICBMs. Obtaining this information on a global basis with the required accuracy would be impossible without space-based systems.[7]

Space Defense and Anti-Satellite Systems

The current US anti-satellite program falls under the broader space defense program; the objectives of this program are to enhance the survivability of US military satellites and spacecraft; provide improved surveillance of space, including warning that our space systems are being attacked; develop an adequate command and control system for space defense; and develop space defense weapons systems, the first being the ASAT.

The increasing capabilities of US military space systems and our operating forces' reliance on them mark military satellites as attractive targets. The Soviet Union's deployment of an operational ASAT system

demonstrates their understanding of this situation and provides the DOD with a requirement for space defense. The survivability of our space systems can be improved through proliferation of satellites with decoys; camouflage and deception; greater autonomy in our satellites; increased shielding against nuclear and electromagnetic radiation; and additional maneuver capability. None of these techniques, singly or in combination, can offer absolute safety, but they can make life more difficult for the ASAT planner on the other side. To further deter the Soviets from using their anti-satellite weapons against our space systems, the United States is developing its own ASAT, thus denying the Soviets uninhibited use of space in times of crisis and a monopoly on ASAT capability.

The US ASAT weapon consists of a missile launched from an F–15 fighter aircraft. The missile is fired into the path of a threatening satellite. First stage power is provided by a short-range attack missile (SRAM) booster, and a small Altair III solid rocket motor is used for second stage power to get the third stage, or miniature vehicle, into position. The relatively small and compact system offers extensive flexibility through the use of the F–15 as a launch vehicle. The missile can be flown from different bases to a computer-generated launch point in space and time to execute a kill. The system could be employed against either threatening satellites or certain types of ASAT weapons.[8]

The Air Force has established a Space Defense Operations Center (known as SPADOC) in Cheyenne Mountain, Colorado Springs, Colorado, to serve as the hub for surveillance information from the Space Detection and Tracking System (SPADATS), missile warning sensors, and information from all sources. The SPADOC will de-

termine if US satellites are under attack and notify the agency responsible for the satellite as well as the National Command Authorities. If given release authority by the NCA, the SPADOC would direct the ASAT launch by providing launch point coordinates and timing information to the F–15. Upon launch, the nonnuclear weapon will be fired into the path of the target.[9]

Space-based lasers and other directed energy weapons are also being investigated to determine their utility for space defense. The technology for building antisatellite laser weapons seems fairly close. Current satellites are easy targets, particularly surveillance satellites, because of the inherent vulnerability of their optical sensors to low levels of laser illumination. Directed energy weapons sufficiently lethal to destroy enemy ASATs—or ballistic missiles—are technically feasible, though farther in the future.

3 / Military Organization for Space

Organizations are usually created as the result of perceived needs, and military organizations are not exceptions to this premise. The expanding importance of space to the military has already caused organizational change, and the change is accelerating. Military space systems have transitioned from the realm of research and development to the operational arena, and organizational patterns are beginning to emerge that reflect this. The transition is not complete; in fact, the complexity and uniqueness of most military space systems defocus the point at which systems become "operational." As a result there still remains a wide distribution of responsibility for space planning and operations within the Department of Defense. Figure 3 is a partial organizational chart highlighting the major space organizations within DOD.

OSD, JCS, and Service Staffs

Centralizing the management of DOD space activities has been discussed for some time, but recently the first steps in that direction have been taken down the corridors of the Pentagon. Within the Office of the Secretary of Defense, the Defense Space Operations Committee, chaired by the Secretary of the Air Force, has been created to deal with all DOD space operations issues. Another step, within the Office of the Under Secretary of Defense for Research and Engineering, Dr. Bob Cooper (Director of the Defense Advanced Research Projects Agency) serves as the principal focus for space research

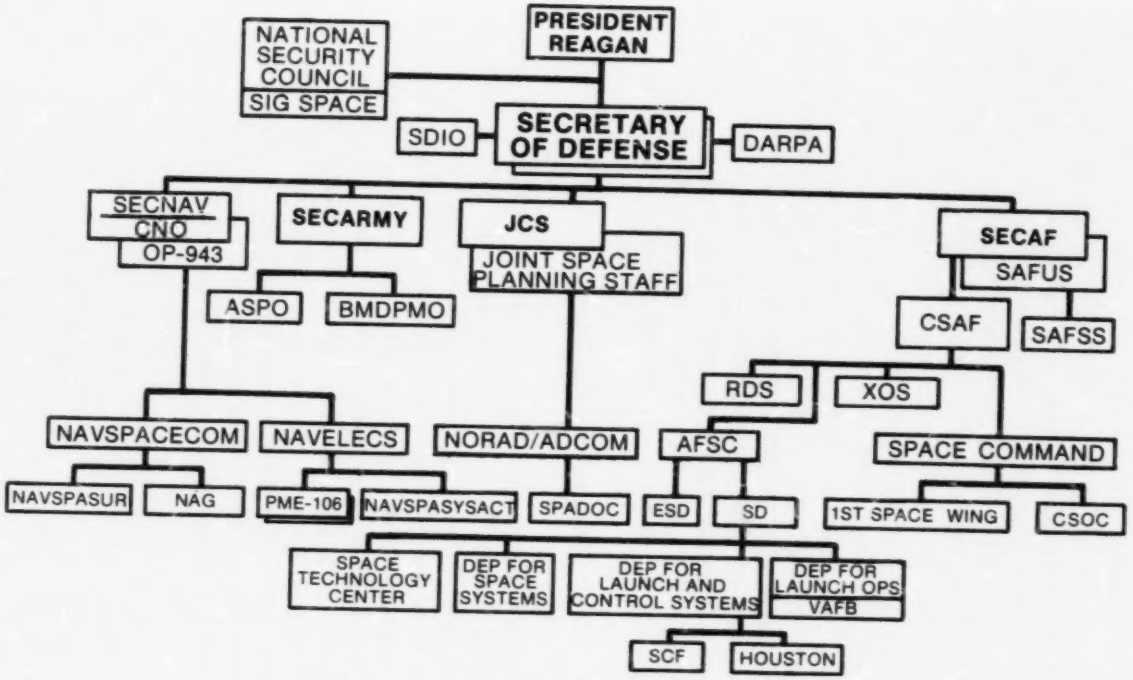


Figure 3. National security space organization

and development across all mission areas. A new executive management structure within DOD, the Strategic Defense Initiative Organization, was created to oversee President Reagan's Strategic Defense Initiatives, as this program will require significant military efforts in space. At the OSD level, thus, we can see progress being made in improving the management organization for space.

On the Joint Staff, space matters remain parceled out among the directorates on largely functional lines. The Director J–5 (Plans and Policy) is responsible for space organization and policy planning; the Director J–3 (Operations), for current space operations less military communications satellite systems; and the Director for Command, Control and Communications Systems (C3S) is responsible for planning and operations of military communications satellite systems and long-term planning, research, and development for military space systems in general. Although this separation of responsibilities has worked reasonably well in the past, recent developments have raised questions as to its future effectiveness. The increased requirements of the Unified and Specified Commanders for space systems both in peacetime and times of crisis, pressures to create a "Unified Space Command," and the emphasis added by the President's Strategic Defense Initiative all have demonstrated the need for a focal point for space actions on the Joint Staff. The Joint Chiefs of Staff approved the creation of a Joint Planning Staff for Space (JPSS) which could address these problems and others, and this organization will be in place and addressing critical joint space planning needs. Major General Brandt, USAF, was named to head the JPSS, and his charter has been approved by the Joint Chiefs.[1]

The Air Staff has made significant strides in centralization of military space activities by creating a Directorate of Space (XOS), headed by a major general, under the Deputy Chief of Staff, Plans and Operations. This staff office consolidates Air Force space operations and planning and interfaces directly with the Directorate of Space Systems and Command and Control Communications (RDS) (another two-star billet), under the Deputy Chief of Staff, Research Development and Acquisition, ensuring that space R&D, planning and policy formulation, and operations are integrated.

The Navy has also recognized the need for consolidation of space activities at the Service staff level and has established the Navy Space Division (OP–943), headed by a flag officer, within the Office of the Chief of Naval Operations (OPNAV) Command and Control Directorate. This office serves as the Chief of Naval Operations (CNO) staff focal point for Navy space activities and as the interface with OSD, the Joint Staff, and the other Services.

Among the three military departments, only the Army has not established a centralized staff organization for space matters at the flag level. Figure 4 shows the widely dispersed space responsibilities among the Army Staff as of the spring of 1984. Space functions and responsibilities on the Army Staff are divided on a functional basis among the Deputy Chief of Staff for Operations and Plans, the Deputy Chief of Staff for Research, Development and Acquisition, the Assistant Chief of Staff for Intelligence, the Army Space Program Office, and the Ballistic Missile Defense Program Managers Office. As a result of this fragmentation, Army participation in joint space matters has been halting and poorly

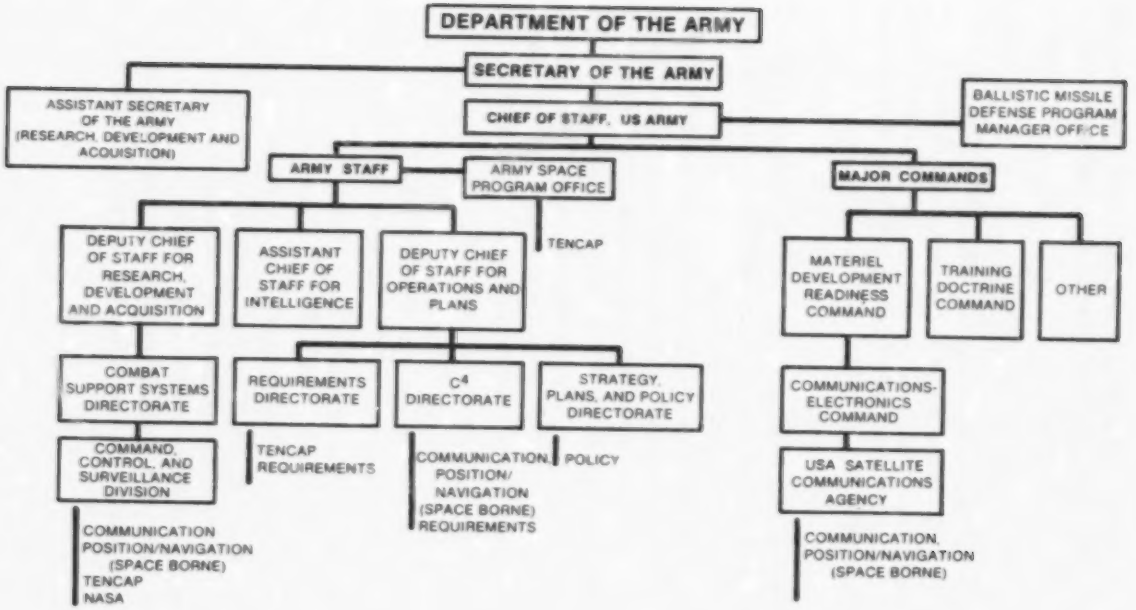


Figure 4. Fragmented Army space organization

coordinated. An Army Staff space conference hosted by the Army War College Strategic Studies Institute in September 1981 concluded:

> Individuals and groups with interests in space can be found in the BMD Program Office, ODCSOPS, ODCSRDA, OACSI, Long-Range Planning, the Army Space Programs Office, and elsewhere. There appears to be little coordination of effort and a distinct need exists for better integration of the space program.[2]

Until recently this lack of focus on space issues may not have had significant impact, but a centralized staff organization is now a necessity, and the Army Staff has recognized this. There are several possible directions which could have been taken to create this staff organization; for example, it could have been formed using either the Army Space Program Office or the Ballistic Missile Defense Program Office as a nucleus. Both of these organizations are charged with space-related activities; however, both are presently focused narrowly in scope and would require significant augmentation to provide overall Army Staff supervision of space activities. Broadening their function might also detract from their primary responsibilities which are oriented toward R&D of specific systems.

A new field operating agency or a new directorate or division within an existing staff agency could have been formed by physically transferring functions and personnel from the present Army Staff agencies. This is probably the most desirable eventual configuration and would be more aligned with the other Service staff, but it would

create serious disruption in current Army Staff space activities, and would receive significant opposition from the Army Staff itself.

The Army decided upon a more evolutionary approach. A formal Army Space Council has been chartered by the Army Chief of Staff and is chaired by the Vice Chief of Staff of the Army. The council consists of the Deputy Chiefs of Staff for Operations, Research and Development, and Personnel; the Assistant Chief of Staff for Intelligence; and the Ballistic Missile Defense Program Manager. In late March 1984, an Army Staff Space Office was established under the Deputy Chief of Staff for Operations and Plans, to act as the executive secretariat for the Space Council and provide full-time focus and coordination on space issues. This office initially will be quite small—a chief, a plans and policy officer, an intelligence officer, a communications officer, and a BMD officer, plus a secretary—but it will ensure space matters are properly staffed by the working groups and will provide the nucleus for future evolutionary expansion. The space working group(s) would consist of action officers from all appropriate Army Staff elements concerned with space issues and be task organized by the Army Space Office for specific issues. (See figure 5.)

Some important functions and responsibilities that should be assumed by this new organization follow:

1. Addressing space concepts, doctrine, requirements, and force structure for the Army leadership.
2. Representing the Army on all OSD and joint staff planning and working groups dealing with space.

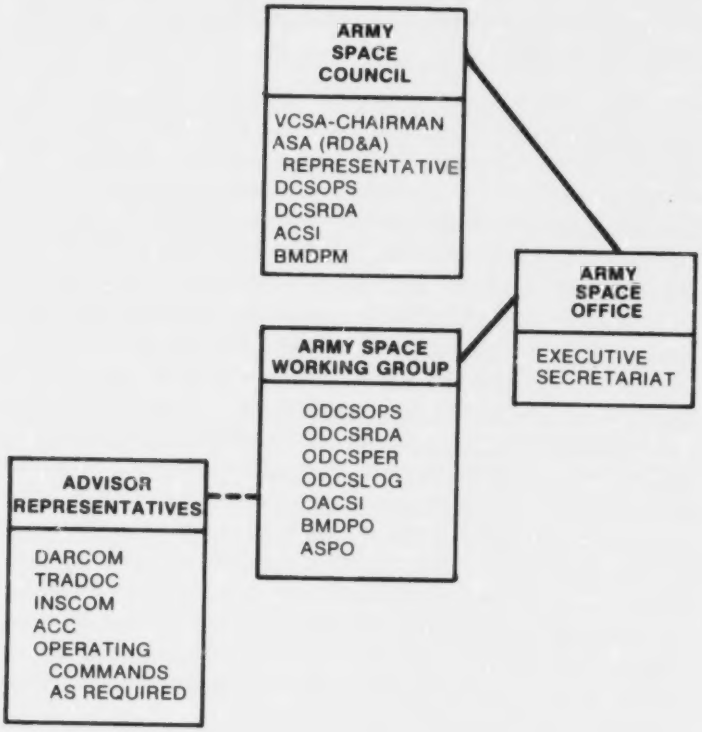


Figure 5. Army management structure for space

3. Reviewing all plans, studies, and actions of the Army Staff and major Army commands which involve space activity.
4. Monitoring the integration of space-related capabilities into the Army's air-land battle doctrine and into future operational concepts.

Space Commands

On 21 June 1982, the Air Force announced the planned formation of a twelfth major command, Space Command, with broad responsibilities for Air Force space operations. On 1 September 1982, the new command was activated, with headquarters in Colorado Springs, Colorado, and with a commander already wearing several hats as the commander of Aerospace Defense Command, a specified command under the Joint Chiefs of Staff, and as the commander of the US-Canadian North American Aerospace Defense Command, a combined multinational organization. The vice commander of Space Command is also dual hatted in that he is also the commander of the Air Force Systems Command Space Division. (See figure 6, Air Force Space Command.)

The creation of Space Command consolidated USAF operational space activities, provided a link between the space-related research and development process and operational users, and centralized space advocacy within the Air Force. Space Command is chartered to examine requirements; plan and program resources; and operate, manage, and control assigned operational space assets. Air Force has also stated that Space Command will be responsible for the operation of the Consolidated Space Operations Center. The center will consist of two major elements, a Shuttle Operations Complex and a Satellite Operations Complex. The shuttle facility will plan and control those shuttle flights dedicated to defense missions, and the satellite operations facility will provide on-orbit command and control of designated military satellites and provide a backup to the Satellite Control Fa-

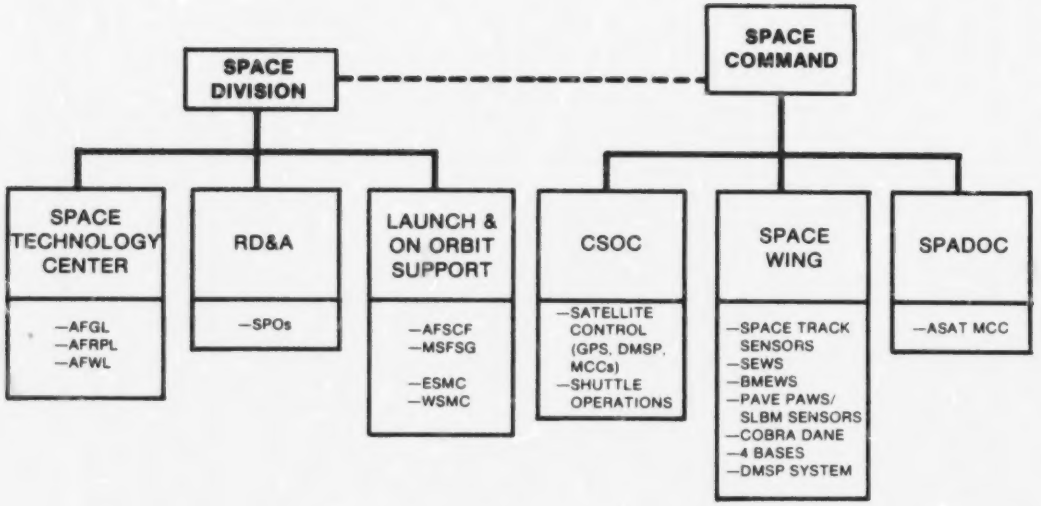


Figure 6. Air Force Space Command

cility in Sunnyvale, California, operated by the AFSC Space Division. Defense of US space assets is a related mission area. The US anti-satellite weapons system will be controlled by the Aerospace Defense Command, using the surveillance and computer facilities of the Space Defense Operations Center.

By creating its Space Command, the Air Force formed an operationally oriented organization to consolidate an increasingly diverse and complex space program. The relationship between Space Command and the Air Force Systems Command, more closely linked than the relationship between other Air Force major commands which operate systems and the systems acquisition organization, should help to ensure a better transition of assigned space systems as they become operational. That transition is usually not cut and dried for space systems.[3]

Almost one year to the day after the Air Force announced it was creating a space command, on 15 June 1983, the Secretary of the Navy announced the establishment of the Naval Space Command (NAVSPACECOM) and activated it on 1 October 1983, with headquarters at Dahlgren, Virginia.[4] Former Astronaut Richard H. Truly, the first commander of NAVSPACECOM, executed a minor coup by carrying the command flag with him on a Space Shuttle flight, allowing the Navy to claim the only space command headed by an astronaut and with a flag flown in space. The missions assigned NAVSPACECOM include providing, operating, and maintaining naval space resources and personnel in direct support of fleet units worldwide; coordinating operational use of existing space capabilities; identifying facilities and system requirements and supporting mission development for cur-

rent and future space systems; and proposing resource allocations for the planning, programing, and budgeting system. Organizations initially assigned to NAVSPACECOM included the Naval Space Surveillance System, the Naval Astronautics Group, and elements supporting the Fleet Satellite Communications System. (See figure 7.) Other Navy space-related programs, such as ocean surveillance and the Navy portion of TENCAP, will probably be assigned to the command as they achieve operational status.[5]

The Navy has not attempted to inter-knit its space research, development, and acquisition organization, Naval Electronics Systems Command (NAVELECS)/PME–106, to its space operating command, NAVSPACECOM, as did the Air Force. The Air Force had some valid functional and political justifications for its decision, but the results have not been completely successful. The Navy effort in space, although expanding and vital to the fleet, is not as extensive as that of the Air Force; the Navy has established its requirement for operational control of space systems and created a command to exercise it.

Army Space Organizations

The Army has yet to establish an operational major space command. The Army organizations that presently are chartered with space-related responsibilities include the US Army Space Program Office, the Ballistic Missile Defense Organization (BMDO), and the US Army Satellite Communications Agency (SATCOMA). These organizations deal primarily in research and development, with some responsibility for engineering, procurement, instal-

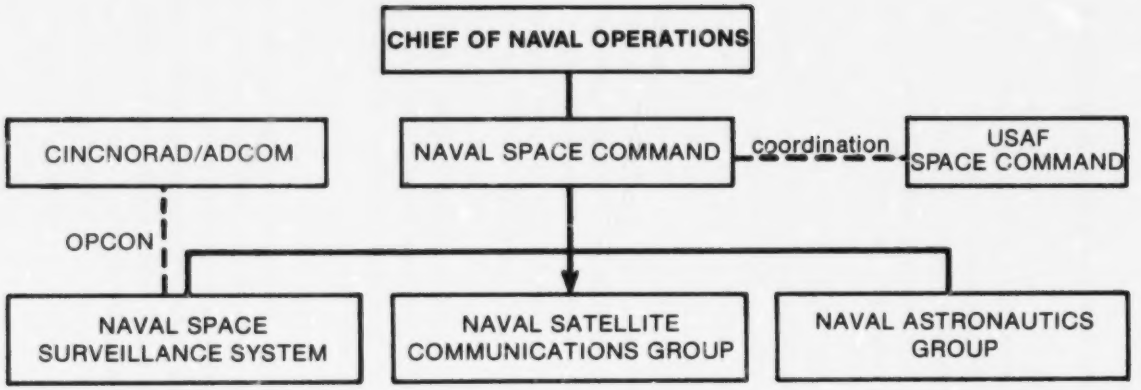


Figure 7. Naval Space Command

lation, and test and evaluation of specific systems.

SATCOMA. A project management and engineering activity, SATCOMA controls responsibility for ground systems and equipments for the Defense Satellite Communications System; Ground Mobile Forces Tactical Satellite Communications; NAVSTAR/GPS, Milstar, and other special satellite systems.

BMDO. The Ballistic Missile Defense Organization develops ballistic missile defense technology. The BMD program provides advanced technological research and integration of maturing technologies into systems design. The organization consists of the BMD Program Office providing management; the BMD Systems Command providing research, development, acquisition, installation, and support of ballistic missile defense systems; and the BMD Advanced Technology Center conducting research and development of advanced component and functional BMD technologies.

The Army Space Program Office. The program office develops requirements and objectives for space programs based on Army tactical user requirements, specifically intelligence requirements.

The Army also has operational units performing space functions such as satellite communication, but these are small organizations assigned to a major command such as Force Command, Training and Doctrine Command, Army Communications Command, US Army Europe, or US Army Korea.

Unified Space Command

On 8 November 1983, the Joint Chiefs of Staff approved, in concept, the creation of a unified space command. Although not scheduled to become operational until 1985, the new unified command's projected creation would reflect the growing importance of space in US military planning and would serve two major purposes. First, it would consolidate operational space planning and responsibilities of all the Services, allowing increased inter-Service support, less duplication, and greater efficiencies. Secondly, it would recognize space as the fourth medium for military action, along with land, sea, and air: an arena where joint operations under a single unified commander are both appropriate and necessary. A unified space command should provide joint planning for wartime space operations and exercise command and control of assigned military satellite systems, the anti-satellite (ASAT) system, military space shuttle missions, and other systems and weapons that may be developed. A major benefit would be having a unified commander to consolidate and support space requirements in the budget process.[6]

Under the provisions of the Joint Chiefs of Staff Unified Command Plan, a unified command must consist of operational component commands of two or more Services. The Air Force Space Command and the Naval Space Command are already in being and would appear to be naturals for component commands within a Unified Space Command. The Army does not presently have a major command for space; however, the Army's Ballistic Missile Defense Organization has been mentioned frequently as a contender to become the Army component. I

disagree with this proposal, however. The BMDO's mission is to conduct R&D and, if authorized, deploy BMD systems. It is not an operations organization, and should a decision be made to enter engineering development and deployment of a Ballistic Missile Defense System, a new organization likely would be formed to operate it. I do think the Army should support a Unified Space Command by providing personnel for its joint staff, and I think that planning for an Army component should begin immediately; however, designating a materiel developer to be the Army component of a Unified Space Command would not be in the best interests of the Army or the Unified Command.

4 / Technology, the Future, and the Impact on the Army

From considering the chapters in which I have discussed the past and present US military space efforts and the role played by the Army, attempts can be made to look into the future beyond the turn of the century. Some may think that this is projecting too far, perhaps into the realm of science fiction, but forecasts can turn out to be on the conservative side. In 1945—when the Army initiated its rocket and space program with von Braun and his associates—no one would have dared to predict a military space program of the magnitude and complexity of our present effort.

Space System Developments

One of the areas that has the potential for dramatic advances in the fairly near term—within 10 years—is that of surveillance. Improvements in sensor technology, space power generating systems, information processing, and communications suggest that all-weather, day and night, worldwide, tactical real-time surveillance systems are feasible. Such systems could provide direct transmission of the information to the tactical commander in a ready-to-use form, without the requirement for large, centralized processing facilities. A commander who can see through "the smoke and haze of battle" and accurately know the location and disposition of the enemy as well as his own forces will have a decided advantage on the battlefield of the future.

Navy and the Integrated Tactical Surveillance System. The Navy is actively pursuing a program that it calls the Integrated Tactical Surveliance System (ITSS). It will be an amalgam of existing and programed systems (on aircraft, terrestrially based, or in space), using radar, infrared, and visible light imaging and other sensors to detect and track enemy ships and aircraft. Many of the near-term, shorter range, and limited coverage components of ITSS will be either terrestrial, such as over-the-horizon radar, or airborne, such as AWACS radar or sensors carried on long-endurance, high-altitude aircraft.[1] To provide the real-time, global coverage desired by the Navy, however, utilization of space-based systems will be required. A dedicated system of space-based radars with complementary infared sensors would be a solution. This type of system, with an on-board processing capability, could provide direct transmission of surveillance data from the sensor platform to the US naval combatant, allowing identification, tracking, and targeting of enemy ships or aircraft while they were still over-the-horizon. As for Service expectations, Commodore Richard Truly, the commander of the Naval Space Command, stated in an April 1984 magazine article that he expected the Navy over-the-horizon radar program to be assigned to NAVSPACECOM, possibly foretelling the emphasis on space in the ITSS program.[2]

Army's Programs. The Army has done a significant amount of work under the TENCAP program to furnish surveillance data from sensor systems to theater tactical commanders; in fact, the Army has been the leader and driving force in this effort. Although the TENCAP program has partially filled a void in tactical battlefield surveillance, it cannot satisfy all tactical requirements.

Because of the limitations of systems, the Army needs to begin thinking about dedicated space-based sensors to perform its battle management functions. Some tentative first steps have been taken. A joint Army and Air Force effort has started based upon work done under a Defense Advanced Research Projects Agency program called Assault Breaker.[3] The purpose of the program was to provide a capability for deep interdiction of targets in the enemy rear area; it would complement the new air-land battle operational concept. The complex joint program would employ an advanced airborne surveillance capability—the Joint Surveillance and Target Attack Radar System (JSTARS)—that will be able to look several hundred miles behind the enemy's FLOT (forward-line-of-troops) to identify targets such as enemy command posts, airfields, surface-to-air missile sites, and armor concentrations. Another element of the program is the Joint Tactical Missile System (JTACMS), a missile containing smart, maneuverable sub-munitions and capable of being launched from bomber or fighter aircraft or from ground mobile platforms. The final element in the overall program is the Joint Tactical Fusion Program that will develop the center to process the sensor data, collate it with other intelligence, and allocate enemy targets. If the system is fielded, JSTARS may prove to be an interim step toward a more capable, space-based surveilliance system in much the same manner as the Navy's ITSS program envisions over-the-horizon radar leading to space-based radar.

Aside from the advantage of a greater field-of-view, or coverage, space-based platforms are prepositioned; they would not require allocation of critical strategic lift assets to transport their platforms or base support to the

theater of operations in times of crisis as will the airborne systems. This shortage relates closely to the United States need for deep strike capability to fight worldwide using the air-land battle concept; a deep strike capability would also greatly enhance NATO's deterrence in the European Theater and compel the Warsaw Pact to revise its force structure, doctrine, and plans.

Army force structure and battlefield doctrine of the future will be based on a concept called Air-Land Battle 2000. A style of waging war, the concept encompasses agility, deception, firepower, maneuver, and all the other tools of combat to face the enemy with a succession of dangerous and unexpected situations more rapidly than he can react to them. Army forces of the future will have to be agile, lethal, and survivable, as well as strategically mobile. Commanders must be able to identify high-value enemy targets, seize the initiative, and use synchronization of effort to fight and win when outmanned and outgunned. Air-Land Battle 2000 is an umbrella concept, placing emphasis on "leverage" technologies that offer the potential for innovative, near-revolutionary change in the major functional areas of combat:

—Command, Control and Communications

—Close Combat

—Fire Support

—Air Defense

—Combat Support

—Combat Service Support[4]

Space systems—either systems already programed or systems yet to be designed—embody US technological

superiority and can enhance the Army's ability to perform these combat functions.

Enhancing the Commander in the Near Term. For a commander to effectively control his tactical elements, he must know where they are and be able to talk to them. The new Position Locating Reporting System (PLRS) developed jointly by the Army and Marine Corps will provide combat commanders with accurate relative location data, but when this ground-based system is integrated with the space-based NAVSTAR/GPS, commanders will have unambiguous worldwide common grid location data—in three dimensions—and an extremely accurate common time reference as well. Information and instructions must be transmitted rapidly and accurately on the battlefield of the future, yet at the same time the vulnerability of the traditional command post with its many electromagnetic emitters must be reduced. Communications satellites of the future with on-board sophisticated signal processing and switching capability could act as remote signal centers, eliminating the forest of antennas that surround our present C3 nodes, using spread spectrum techniques which will reduce probability of detection. Satellite-to-satellite cross-links will eliminate the need for terrestrial relays, and terrain and distance will no longer be obstacles to communications.

Space systems clearly will allow the tactical commander to precisely locate his own forces and communicate with them; when this capability is combined with space-based surveillance and target acquisition systems that will provide him real time information on the enemy's forces, the commander will have the ability to plan maneuvers and coordinate firepower to gain and maintain momentum and ultimately destroy the enemy's

ability and will to continue the battle. The systems reviewed so far are certainly feasible within the 10 to 15 year time frame and complement combat functions such as command, control and communications; fire support (real-time target acquisition); air defense (space-based radar to detect and track enemy aircraft); and combat support.

In the 20 to 30 year time frame, tactical space-based weapons systems are possible that could revolutionize the close combat, fire support, and air defense functional areas. The air-land battle doctrine was created to integrate the capabilities of new systems that increased the Army's mobility, firepower, command and control, surveillance, and target acquisition, but tactical space-based, directed, or kinetic energy weapon systems may require an entirely new strategy and doctrine.

The entire concept of "Close Combat" as we now know it may become passé. Space-based nonnuclear weapon systems with small CEPs and variable destructive capability could be used surgically against enemy targets; combined with a global, all weather, day or night surveillance and target acquisition system and a battle management computer system, the appropriate space weapon could be chosen: directed energy for time-sensitive targets such as missiles or aircraft, kinetic energy for fixed or slow moving targets. Because the weapons would be space-based, they would have the double-edged advantage of being remote from their targets yet capable of rapidly delivering their destructive energy to any point on earth.

Space weapon systems would necessitate drastic modification of the air-land battle concept; because

firepower (or fire support) would clearly be more important than close combat, there would be no requirement for large combat formations of men and armor (or for battleships and large aircraft carriers for that matter). The battle may be centrally planned and synchronized, but it will be executed by small, self-sufficient units that utilize the full potential of space-based acquisition, targeting, and weapons systems to combine intelligence, firepower, and rapid maneuver in continuous operations. The warfighting concept of the future might more logically be called "Air-Land-Space Battle 2000" with a spherical battle zone whose radius extends into space, limited only by technology.

Relative to this vision of the future with its emphasis on space and high technology, back in 1910 General Ferdinand Foch said of the airplane, "That's good sport, but for the Army the airplane is no use." In 1945, President Truman's Chief of Staff, Admiral William Leahy, said of the atomic bomb, "That's the biggest fool thing we've ever done. The bomb will never go off, and I speak as an expert on explosives." In 1946, Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, said of intercontinental ballistic missiles, "I say technically I don't think anybody in the world knows how to do such a thing, and I feel confident it will not be done for a very long period of time to come." All of these "expert" critics were proven to be wrong, and they were proven wrong quickly. At the present, the Army is only beginning to even explore the fringes of space utilization; concentrated research and development will be required. The Strategic Defense Initiative may provide spinoffs that will suggest tactical battlefield applications.

Missiles and Our Multi-Layer Defense

Since the inception of the space program a quarter of a century ago, when ballistic missile defense possibilities were first considered, the threat has evolved from a postulated one to an actual force of over 1,000 ballistic missiles with thousands of nuclear warheads that are targeted against the United States and its allies. The situation is further complicated by the proliferation of tactical and intermediate-range ballistic missiles, many of which also carry several warheads.

Based on President Reagan's challenge to address this threat, the Fletcher panel concluded in the Defensive Technologies Study that the United States has identified promising technologies to pursue if we can develop ballistic missile defense capabilities that would be effective not only against today's missiles but also those an enemy could reasonably be expected to develop to counter our defense system. As a prediction, this eventual defense system will likely consist of layers using different concepts and technologies, optimized to attack the missile during the various phases of its flight.[5]

Ballistic Missile Defense. The flight of a ballistic missile may be broken into four phases (see figure 8). In the boost phase, the first, second, and third stage (SLBMs and some ICBMs only have two stages) engines of the missile are burning, producing an intense, unique infrared signature. This phase lasts from 180–240 seconds for ICBMs and propels the missile out of the atmosphere. Attacking the missile in this phase is advantageous because it is relatively vulnerable, and the attacking vehicle has considerable leverage—destruction of one booster

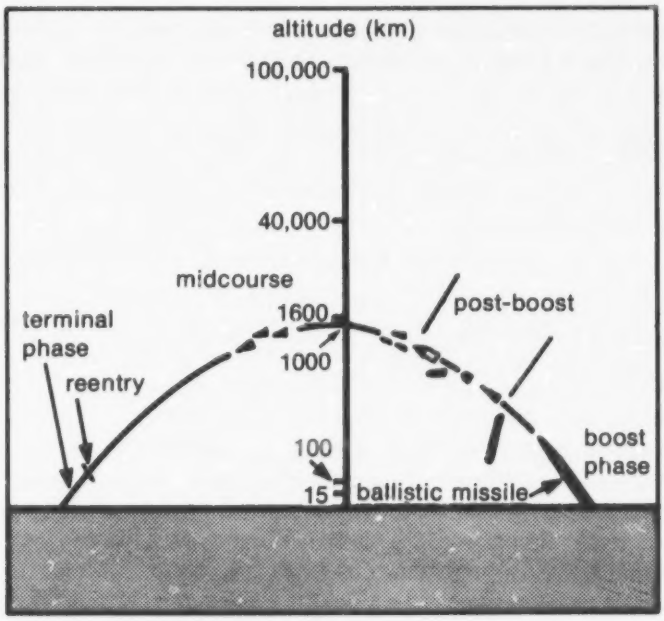


Figure 8. Ballistic missile trajectory phases

can eliminate up to 10 reentry vehicles. The major disadvantage comes from the fact that a boost phase defensive system would almost certainly have to be space-based.

In the missile post-boost, or bus-deployment, phase, multiple warheads are deployed along with penetration aids such as decoys and chaff. This phase may last a few to several hundred seconds while the post-boost vehicle or "bus" maneuvers to achieve a variety of very precise trajectories, deploying reentry vehicles and penetration aids on trajectories to attack different targets. Ballistic missile defense in this phase has less advantage, because

the bus is a harder target as it is maneuvering, and the infrared or radar signature is much less detectable than that of the booster; the short time requirement—less than 10 minutes from initial launch for current systems—would also probably dictate a space-based defense component and a human decisionmaker would be included in the loop.

In the mid-course phase, warheads and penetration aids travel on ballistic trajectories for roughly 25 to 30 minutes, reaching a maximum altitude in excess of 1,000 kilometers before falling toward the earth and its atmosphere. Because of the relatively long time available for interception, the defense can be more deliberate and can employ successive attacks on the reentry vehicles, perhaps using different types of weapons—space-based directed energy and long-range ground-based missiles, for example. Of course, the defense has to be able to distinguish between warheads, decoys, chaff, and debris and only attack the warhead reentry vehicles. Not a trivial task.

In the final, or terminal phase, which lasts only about 15 seconds, the warheads and penetration aids reenter the atmosphere and close on their respective targets. The atmosphere acts to filter out the decoys and chaff from the actual warhead reentry vehicles, making discrimination easier for the terminal phase defense; however, the time frame is so compressed that after the decision is made to activate the system, no human intervention except override is possible—the complex network of sensors, computers, and interceptors must function automatically.[6]

The advantages and disadvantages of attempting to defeat the ballistic missile in each phase demonstrate the

value of a multi-layered defense, a defense which engages targets in each phase and can perform the following key functions:

—Global full-time surveillance for rapid and reliable warning.

—Early boost-phase intercept to minimize the number of targets to be handled in later phases.

—Rapid and effective discrimination of warheads from penetration aids or debris to eliminate the attacker's option to attempt to overwhelm and exhaust the defender's resources.

—Warhead interception early in the terminal phase to avoid collateral damage from warheads "salvage-fuzed" to detonate when intercepted.

—Surveillance, acquisition, tracking, and kill assessment; battle management; communications; and data processing using systems that are interconnected and survivable.

President Reagan's Strategic Defense Initiative addresses each of these key functions. The President's program does not propose a particular system for ballistic missile defense, but it is a research program to vigorously pursue important technologies that will be required should a decision be made in the future to deploy BMD.[7]

Before looking at this program in detail, it might be wise to review some additional ballistic missile defense basics and some of the past and present Army efforts in BMD. BMD systems must deal with three general problems:

1. Defending the target and successfully coping with penetration aids and countermeasures. The different targets BMD could protect differ in the level of performance they require of the system. A key element in performance requirements is "leakage," the percentage of incoming warheads that penetrate the defense. The lower the leakage, the greater the technical demands on the system. A target set consisting of multiple hardened point targets, e.g., the Minuteman ICBM force, with an acceptable leakage rate based on the number of our ICBMs we require to survive (something less than 100 percent) is the least demanding for BMD. A target set which consists of multiple nonreplaceable soft area targets, e.g., the cities and population centers of the United States, with low to no leakage acceptable, is the most demanding.

2. Defending the BMD components—the sensors, the command and control system, the weapons system—so that the enemy cannot cause a collapse of the complete system by targeting its components. This requirement for self-defense has been frequently cited as the Achilles heel of BMD when combined with the next problem.

3. Gaining favorable cost-exchange ratios in relation to the offensive systems. In the past, it has clearly been cheaper for the offense to build more missiles and saturate or destroy the defensive system.

In solving these problems, past and present Army BMD systems have evaluated their success or failure.[8]

Army Ballistic Missile Development. The Army BMD effort was initiated back in 1955 when Bell

Laboratories was asked to develop a variant of the Nike-Hercules nuclear armed anti-aircraft missile that would be able to shoot down incoming ballistic missiles above the atmosphere. The result was the Nike-Zeus system, which became the forerunner for virtually all US BMD systems. Although the Army had conducted a series of tests at the Kwajalein missile range by the early sixties that indicated that Nike-Zeus could shoot down incoming RVs from first generation US ICBMs, there was significant doubt of the system's ability to function against a realistic Soviet threat—specifically a future threat that might include penetration aids and multiple RVs. As a result, Secretary of Defense McNamara redirected the Army fiscal 1963 program from Nike-Zeus to research and development of technology for a new, more capable BMD system called Nike-X. It would supplement the long-range Zeus missile with a faster, short-range interceptor that could destroy enemy RVs after they enter the atmosphere, and it would employ a new phased-array radar and computer technology to handle multiple threats simultaneously.

In 1967, Secretary McNamara announced a US decision to deploy a BMD system using some of the components developed under the Nike-X project called Sentinel. The system reflected a redirection of the thrust of the BMD program from a full defense against the Soviet threat to a "thin" defense against accidental launches or the nascent Chinese threat. Congressional opposition to the system created further delays, and when the Nixon administration took office in January 1969, the decision was made to suspend the Sentinel program.

In March 1969, President Nixon announced a reoriented BMD program called Safeguard. Like Sentinel,

Safeguard would provide a two-layered defense, both exo- and endoatmospheric. Developed and deployed in the late 1960s and early 1970s, Safeguard became operational in 1975 and was inactivated in 1976. The system comprised two radars and two interceptor missiles. The long-range Perimeter Acquisition Radar (PAR) would locate and track the attacking force first. On the basis of PAR data, the shorter range, battle management Missile Site Radar (MSR) would launch and guide a long-range Spartan interceptor (an "up-rated" Zeus missile) into the midst of the threat cloud well above the atmosphere. The X-rays released by the explosion of the nuclear megaton-range Spartan warhead would destroy enemy RVs in a wide radius, providing its greatest advantage, an area kill capability that allows one defensive missile to destroy a large number of enemy warheads.

The Army initiated the prototype demonstration of the Low Altitude Defense System (LoADS—later Sentry D) principally to protect the MX in its selected basing modes. Sentry, as such, was cancelled, and the effort evolved into an SDI element for terminal and mid-course defense. Sentry design consists of a small inertial guidance interceptor one-half the size of the Sprint missile paired with a small hardened radar. Each Sentry missile/radar pair defends an individual target. The interception would not begin until the incoming RVs nearly reached their target, when all chaff and decoys would have been filtered out. Because the radar is only concerned with detecting and tracking warheads that enter its small threat cone that are aimed at its defended target, radar and computer system requirements are less stringent. Sentry was designed to be both small and mobile, which makes it a candidate for defense of a mobile Midgetman or a

possible Anti-Tactical Ballistic Missile. The prime disadvantage is that the system is only suited for defense of hardened point targets because the low altitude of interception would result in collateral damage to soft targets.

To defend ICBM silos, the Swarmjet concept builds on the premise that Minuteman survival against a nominal Soviet warhead could be achieved with a minimal keep-out distance. Each silo would be defended autonomously with a shotgun-type launcher that spews swarms of projectiles. The launchers are deployed in hardened silos in the vicinity of the silos to be defended. Upon tactical warning of Soviet attack, covers would be removed from silos protecting small radars. The radars would operate on a trilateration scheme to track the incoming RV. The projectiles would kill by kinetic energy, and a baseline design would have 12 launchers, each one launching 800 projectiles. The system would be provided with spare radars, and only as many radars and launchers would be exposed from their silos as required to destroy an incoming warhead. The low altitude of intercept would allow the atmosphere to filter out chaff and decoys, reducing the sophistication required of the radars. The system would be technically simple, relatively cheap, and would use available technology. The system's primary disadvantage is the same as that of LoADS; it could only be used to defend hardened point targets, such as ICMB silos, where some leakage would be acceptable and collateral damage would not be a problem.

One of the latest BMD proposals, a nonnuclear kill (NNK) system, would involve a combination of phased-array radars, optical sensors, and interceptors with conventional warheads. There are several different versions

of this system with low- and high-endoatmospheric and exoatmospheric interceptors and missile and airborne optical tracking systems. The Army has conducted tests under the Designating Optical Tracker (DOT) program to verify sensor concepts and the Homing Overlay Experiment (HOE) to demonstrate exoatmospheric homing and nonnuclear kill. Systems using homing NNK warheads and a combination of radar and optical sensors may provide mid-course and terminal phase defenses which adequately resolve the basic BMD problems, and could provide an effective two-tiered defense for selected target sets by the 1990s. Combined with future space-based mid-course and boost phase systems, an evolutionary ballistic missile defense of the entire country could be possible in the 2000+ time frame.

The President's Strategic Defense Initiative will be investigating new technologies necessary for this long-term evolution.[9] Some of the specific areas that will be investigated are surveillance, acquisition, tracking, and kill assessment; battle management; and interception and destruction of the enemy missiles. Studying optical, infrared, and radar signatures of ballistic missiles in each phase of flight will aid in evaluating new sensors and will be a continuing effort. New techniques of radar imaging will be pursued, such as those demonstrated in NASA's synthetic-aperture radar missions on the Space Shuttle, as well as optical synthetic-aperture imaging, using laser rather than radar beams. A program to develop large-format staring focal plane array infrared sensors and rapid signal processing will be included in the surveillance, acquisition, and tracking technologies effort.

Four key demonstrations are planned in the near term, with the possibility of more in the 1990s as technol-

ogy progresses. One demonstration of advanced boost-phase missile detection will incorporate many features already contained in the Air Force Advanced Warning System program. Another will demonstrate capability to track and discriminate attacking RVs in the mid-course phase; it will incorporate much of the work already done under the Air Force Space-Based Surveillance System program. The Army will continue technical demonstrations in the terminal defense area, using ground radars for imaging and tracking, as well as airborne infrared sensors to identify and track reentering RVs (part of the Army's Airborne Optical Adjunct Program).

Battle management and command and control of a multi-layered defense system will be complex and crucial to success. Development and demonstration of this capability will be among the most difficult of the SDI technology effort. Technology programs will develop fault-tolerant, radiation-hard processors that can survive in a hostile space or nuclear environment. Very High Speed Integrated Circuits (VHSIC) technology will be important. Development of the software will also be a major effort because extremely sophisticated and reliable software will be critical to an effective defense.

To intercept and destroy the enemy warheads, new weapons systems must be developed, particularly for boost-phase kill. For several years, DOD has had an extensive directed-energy technology program. The manpower encompasses development of high-power eximer, free electron, and short-wave chemical lasers plus research on the critical areas of pointing and tracking and large, lightweight optics. All three Services have been involved in developing HEL (high-energy laser) weapons test beds. In 1973, the Air Force used a high-energy gas

dynamic laser to shoot down a winged drone at Kirtland AFB, New Mexico. In 1976, the Army used a high-energy electric laser in its Mobile Test Unit and destroyed winged and helicopter drones at Redstone Arsenal. The Navy used a chemical laser to destroy a TOW anti-tank missile in flight in 1978. And the Air Force scored a significant first in 1983, when it demonstrated a kill against a winged drone using a laser carried on board a KC–135 aircraft, the Airborne Laser Laboratory (ALL).[10]

The largest laser weapons demonstrations planned in the SDI are based on the DARPA TRIAD program and include the Talon Gold pointing and tracking experiment, the Alpha chemical laser experiment, and the large-optics demonstration experiment. Other experiments will validate the use of ground-based lasers reflected by space-based mirrors to make boost-phase intercepts. Major experiments in neutral-particle-beam generation and control are planned for the White Horse Accelerator at Los Alamos.

Kinetic energy weapon technology is directed toward interceptors targeted against ICBMs in all four phases of flight. Infrared sensors could be developed for homing nonnuclear warheads used to intercept RVs in the outer reaches of the atmosphere. Similarly, very small, guided optical homing interceptors will be investigated for mid-course destruction of enemy missiles outside the atmosphere. Hypervelocity-gun (electric or rail gun) technology offers promise for kinetic energy kills in the boost and post-boost phases. These guns would be space-based and use electric currents to accelerate homing projectiles to much higher velocities than achieved by conventional rockets. A ground-based hypervelocity gun facility will be constructed to demonstrate the feasibility of high-

acceleration homing projectiles. Both endoatmospheric and exoatmospheric anti-ballistic missiles will be demonstrated by the Army in continuation of their BMD program. Space-based, rocket propelled homing interceptors for mid-course destruction of enemy warheads will also be investigated.[11]

Space-based defenses could be attacked by an opponent using conventional ASATs or directed-energy weapons. Thus, major programs under SDI will identify effective counters to such threats. The system must be able to survive to perform its function of defending the United States and its allies.

As a research program, some of the President's SDI funding will be new, but a significant part comes from channeling or redirecting existing programs so that they form a coherent part of the new overall SDI program. With the Army's key role in strategic ballistic missile defense research, the technologies developed under SDI could be applicable to other Army missions such as point defense against tactical ballistic missiles and aircraft. All of this critical effort in the space arena ensures that these technologies are incorporated into the Army of the future.

5 / Recommendations

A growing commitment of funds and resources must match an expanding military role in space. Given the present fragile state of the economy, the growth of the Federal deficit, and the conflicting demands for social programs as well as defense, obtaining and allocating funds for a massive new military space effort will be herculean tasks. If all Americans perceived the immediacy of the Soviet challenge and accepted the validity of the threat to our freedom and national survival, and agreed with the proposed solution, the task would certainly be easier. This is not the case, however; many citizens and members of Congress believe we spend too much on defense already.

Within the uniformed services, there is a lack of unanimity as to the relative importance of space systems when compared with tanks, ships, and aircraft. The annual POM (Program Objective Memorandum—the Service budget document) cycle includes struggles between competing programs for priority in allocation of funds, and each year the competition between ongoing programs and new systems becomes tougher. Each Service has a traditional core of programs around which it structures its budget, and the constituency of these core programs is well intrenched and influential. How many flag officers of any Service are prepared to abandon the conservative approach of attempting to match the Soviets—weapons systems for weapons systems—with perhaps some trade-off between quantity and quality and push

for dramatic technological superiority? Adherence to this traditional core is especially predictable if the thrust of this technology is outside of the perceived Service core area of interest.

Faced with a smaller slice of a shrinking DOD budget pie, the Army is not about to look for new ways to spend its money. The high-altitude air defense issue represents a recent example of the Army's push to reduce rather than expand its roles and missions. The Army and the Air Force are said to be studying the transfer of all high-altitude air defense responsibility (along with the resources) to the Air Force. This would be a significant move because of its possible long-range effect on the force structure and budgets of both Services. The Patriot high-altitude air defense missile system would be transferred to the Air Force. Manpower requirements for the Patriot system alone would involve about 10,000 spaces, although the projected program cost for the new weapon would be $11.6 billion—the second largest line item in the Army's five-year budget plan. According to the *Army Times*, "officials said the services decided to study the high-altitude air defense issue because of budget considerations, rather than any operational problems with the current structure."[1]

Frequent rumors also circulate around the Pentagon that the Army would be willing to give up its BMD mission to the Air Force as well. Officers on the Air Staff seem receptive; the Air Force even has its own acronym for BMD—DABM—Defense Against Ballistic Missiles. Although often criticized for detrimental competition and needless duplication, Services overlap some missions inevitably. But some overlap is even desirable to ensure our ability to operate in a joint environment.

Space is not a mission, it is a *place*—a place where many missions can be performed. Many of these missions are common to all Services; surveillance, navigation, and communication are examples. Because of the growing importance of space to all military operations, the Army has to maintain and expand its role in space if it wishes to maintain its viability. Just as the horse cavalry transitioned to the heliborne "Air Cav" in less than 30 years because the horse was not viable on the modern battlefield, the Army itself must transition into the Army of the future. Technology will continue to cause changes in the way wars will be fought, and the pace of technological change is accelerating. But, the future application of space technologies will be channeled by the emphasis and resources applied by the Services. As the Air Force and the Navy are not going to direct anything toward Army-specific missions, the Army must tend to its business.

What should the Army do? Three things:

1. Develop a cadre of space-qualified personnel and the necessary organizational structure for them to operate in.
2. Continue to play a lead role in BMD and the Strategic Defense Initiative Program because of the vital importance of Army involvement in space R&D.
3. Ensure that Army doctrine evolves in step with advancing technology.

Developing Trained Personnel. The Army presently does not have an adequate method to train or keep track of officers once they have qualified in space operations. The Air Force has moved the furthest of any of the Services in this area and has a career field, 20XX, Space

Operations, that receives extensive coverage in the Air Command and Staff and Air War College curriculums. The Air Force also established an undergraduate space major at the Air Force Institute of Technology. The Navy established a system of formal identification of naval officers with space experience; they have inaugurated a post-graduate degree program in space engineering and operations at the Naval Post Graduate School. In comparison, the Army once again is a poor third.

There is no established career management program for space-related career fields in today's Army. Established accession and training programs, career progression paths, and assignment policies are, of necessity, geared to known requirements, and the Army has yet to define its requirements for space. Many Army Additional Skill Identifiers (ASIs) relate to specific parts of the Army space effort, such as 3E (TENCAP) relating to intelligence aspects, but there needs to be a more encompassing specialty code—an umbrella code—under which all officers with experience or training in space-related disciplines can be placed. Even the Army astronauts should carry this code (the Army now has two astronauts—Col. Robert Stewart and Maj. (P) Woody Spring).

Too few Army officers qualify in space operations; the Army needs to adequately manage the ones it has. Army also needs to train more. No space-related instruction is taught at Fort Leavenworth and only an elective course at Carlisle. As a remedy, the Army can easily use either the Navy or Air Force post-graduate programs; no attempt needs to be made to duplicate this capability. But the Army should at least provide some orientation on space at the staff college and senior Service college level for all officers.

As for Army Staff organization, the Army is moving in the direction shown in figure 5, however, with some difficulty in identifying the right personnel to fill the positions. In the not too distant future, that organization should be mirrored at the major Army command headquarters and at the Army component headquarters of the unified commands so knowledge of space operations and its applicability to the Army's roles and missions promulgate throughout the Army. Additionally the Army's requirements, viewpoint, and contributions must be firmly presented and supported in all joint space planning. To do that, the Army must seek billets on the OSD Strategic Defense Initiative Program staff, the OJCS Joint Planning Staff for Space, and eventually, the Unified Space Command and other Unified & Specified commands. These billets the Army must fill with knowledgeable and capable officers who have had representative assignments in the space field.

Retaining a Role in Development. Perhaps the most difficult of the three recommendations to accomplish, the research development effort involves allocating scarce funding to programs that produce no increase in Army readiness or force structure. In the near term, it is unlikely that any revolutionary technological breakthroughs will occur.

Conception and development of new weapons systems follow two methods. The classical path proceeds from strategy/doctrine/threat to operational needs to specific military requirements that the technological world attempts to specify—operational pull. The alternative approach begins with new technological discoveries emerging from universities, civilian industry, or Government laboratories. Based upon the existence of the tech-

nology, the new weapons system and complementing tactical concepts are devised. This method is referred to as technology push. Both courses have produced successful weapons and tactical employment concepts. The determining factors in deciding which approach is used are the technical competence of the operational community, the philosophy of the Service, the cooperation between industry and the military, and the funding available to exploit technology. Emphasis varies within the American military establishment. In this realm the US Army does an excellent job at studying and articulating concepts and doctrine.

Army weapons system development follows from the definition of doctrine. This philosophy, the operational pull approach, was demonstrated clearly in the Air-Land Battle 2000 concept. The Air Force, on the other hand, has been characterized as an organization which examines technology, makes something out of it, and then later fills in the doctrine and tactics manual to conform to the new weapon.

The existence of two different approaches to the future, one technologically centered and one operationally oriented, points out the need for a strong operation-scientist dialog, but the problem of establishing a basis for understanding and communication between the operational and technical communities of the military services is a difficult one. The *operator* must rely on the ideas of the technologist in outlining future employment concepts, but all too often the technologist fails to appreciate present operational requirements, let alone foresee those of the future. This situation makes feasibility demonstrations with prototype weapons valuable. In fact the Army concluded in a recent study, Operation Hindsight, "*most*

technological advances ... resulted from the conduct of experiments with real hardware and software rather than pure analytical research."[2] The Strategic Defense Initiative Program will be structured around these kinds of demonstrations. Directed-energy weapons, improved satellite communications, and real-time battlefield surveillance are but a few of the SDIP technology-development efforts that can be used by the Army with little or no modification and that will eventually justify the resources invested.

Advancing Doctrinal Development. The Army must continue to merge the latest space technology into its evolving concept for warfighting. The military services are good at handling well-defined current problems. The process of long-range planning and strategy and doctrine development gets weaker as we look farther into the future, however. The Army attempt to forge ahead, Air-Land Battle 2000, touted as an evolutionary conceptual framework, encompasses the new technologies. The Army has the organization, the Combined Arms Combat Development Activity (CACDA) under the Training and Doctrine Command, to explore and develop new doctrinal concepts and recommend changes to Air-Land Battle 2000. Perhaps in the future, the Army will assign officers with varied space experience and technical knowledge to CACDA and encourage them to use intelligence and imagination to chart the Army's future.

The Army played a lead role in the beginning of the American military space program, and that program was a wise investment that can provide manifold returns in the future, if the Army does not withdraw too soon from its role in space.

Endnotes

Introduction

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Abbreviations

ACC	Army Communications Command
ACSI	Assistant Chief of Staff for Intelligence
AFGL	Air Force Geophysics Laboratory
AFRPL	Air Force Rocket Propulsion Lab
AFSC	Air Force Space Command
AFSCF	Air Force Satellite Control Facility
AFWL	Air Force Weapons Lab
ASA (RD&A)	Assistant Secretary of the Army (Research, Development and Acquisition)
ASAT MCC	Anti-Satellite Mission Control Center
ASPO	Army Space Program Office
BMDPM	Ballistic Missile Defense Program Manager
BMDPMO	Ballistic Missile Defense Program Managers Office
BMDPO	Ballistic Missile Defense Program Office
BMEWS	Ballistic Missile Early Warning System
CBT SUP SYS	Combat Support Systems
C4	Command, Control, Communications & Computers
CINCNORAD/ ADCOM	Commander-in-Chief, North American Aerospace Defense Command/ Aerospace Defense Command
CNO	Chief of Naval Operations

COBRA DANE	Radar name
COMM POS/NAV	Communication Position/Navigation
CSAF	Chief of Staff, US Air Force
CSOC	Consolidated Space Operations Center
DARCOM	Army Materiel Command
DARPA	Defense Advanced Research Projects Agency
DCSOPS	Deputy Chief of Staff for Operations and Plans
DCSRDA	Deputy Chief of Staff for Research, Development & Acquisition
DMSP	Defense Meteorological Satellite Program
ESD	Electronic Systems Division
ESMC	Eastern Space/Missile Center
GPS	Global Positioning System
INSCOM	Intelligence and Security Command
MCC	Mission Control Center
NAG	Naval Astronautics Group
NAVELECS	Naval Electronic System Command
NAVSPACECOM	Naval Space Command
NAVSPASUR	Naval Space Surveillance System
NAVSPASYSACT	Naval Space Systems Activity
NORAD/ADCOM	North American Air Defense Command/Aerospace Defense Command
OACSI	Office of the Assistant Chief of Staff for Intellligence
ODCSLOG	Office of the Deputy Chief of Staff for Logistics
ODCSOPS	Office of the Deputy Chief of Staff for Operations and Plans

ODCSPER	Office of the Deputy Chief of Staff for Personnel
ODCSRDA	Office of the Deputy Chief of Staff for Research, Development and Acquisition
OPCON	operational control
PAVE PAWS	Radar name—not acronym
POS/NAV	Communication Position/Navigation
RDS	Director of Space Systems and Command, Control and Communications
SAFUS	Under Secretary of the Air Force
SCF	Satellite Control Facility
SD	Space Division
SDIO	Strategic Defense Initiative Office
SECAF	Secretary of the Air Force
SECARMY	Secretary of the Army
SECNAV	Secretary of the Navy
SEWS	Satellite Early Warning System
SIG	Senior Interagency Group
SPADOC	Space Defense Operations Center
SPO	System Project Office
TENCAP	Tactical Exploitation of Naval Space Capabilities
TRADOC	Training and Doctrine Command
VAFB	Vandenberg Air Force Base
VCSA	Vice Chief of Staff, US Army
WSMC	Western Space/Missile Center
XOS	Directorate of Space Operations

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Colonel Arthur J. Downey is presently serving as the Deputy Director for Command, Control and Communications Systems, Headquarters, United States European Command at Patch Barracks, Stuttgart, West Germany.

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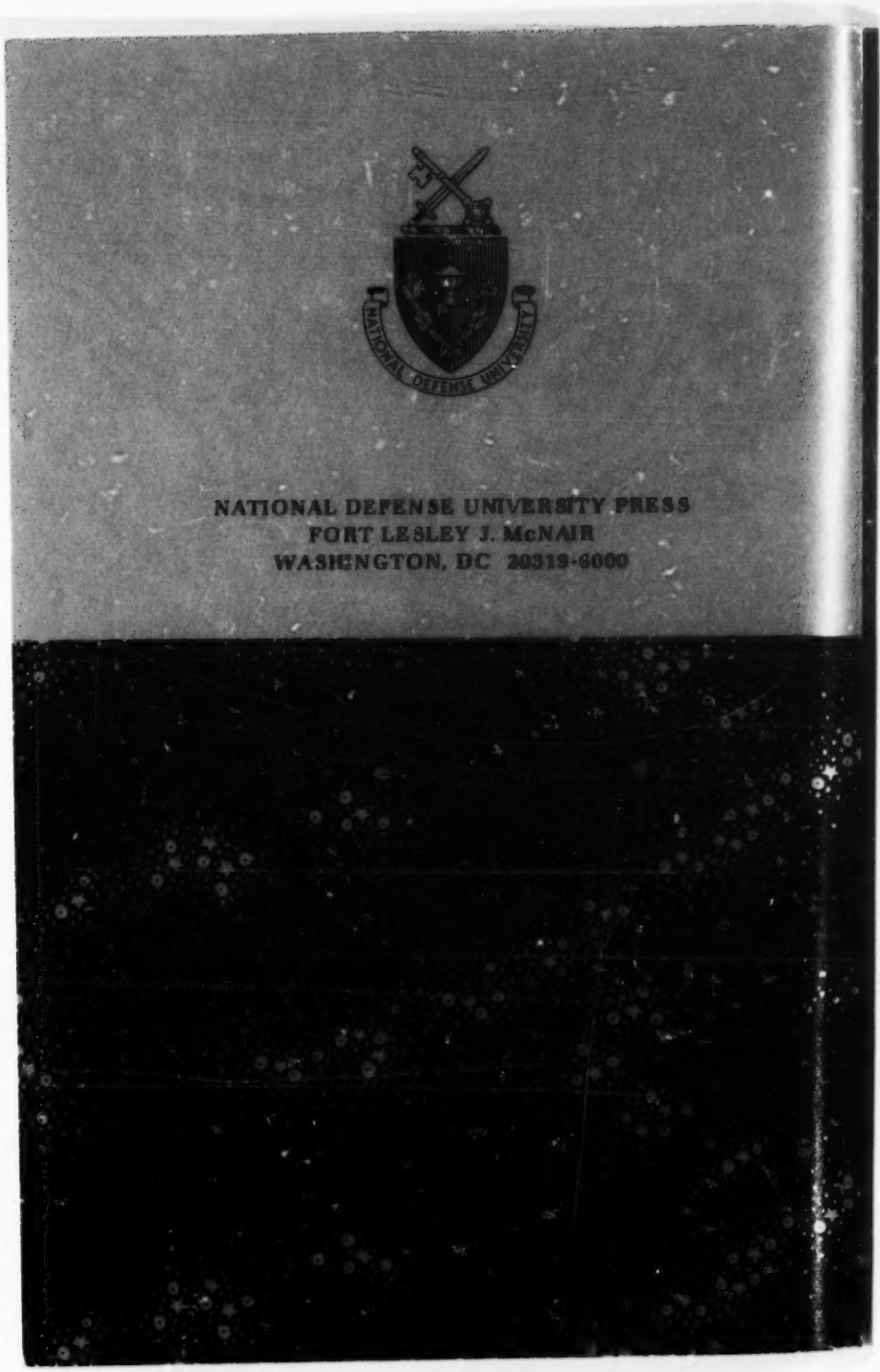

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